Compressed Air Magazine

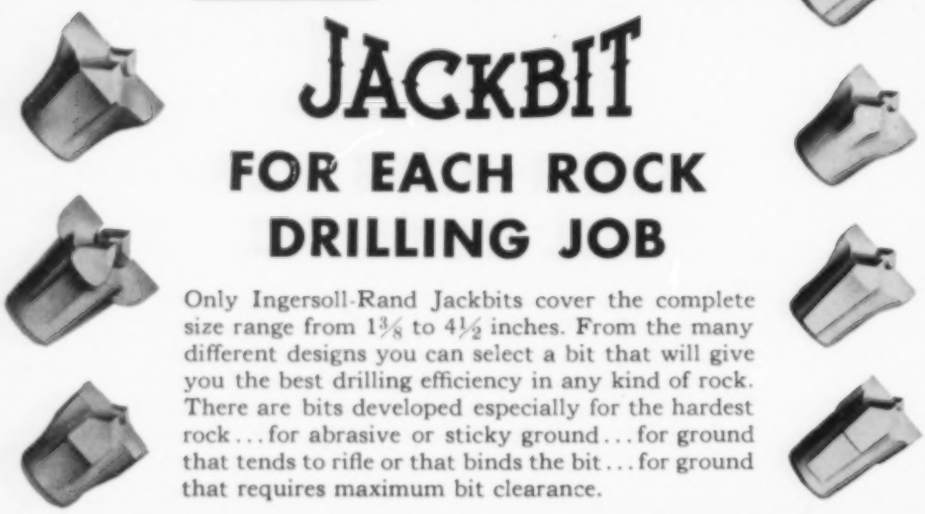
VOLUME 47 · NUMBER 12 DECEMBER 1942 LONDON · NEW YORK · PARIS

A CUSHION PATTERN MADE WITH COMPRESSED AIR

Only JACKBITS offer these 3 advantages

1

THE RIGHT DESIGN OF JACKBIT FOR EACH ROCK DRILLING JOB



Only Ingersoll-Rand Jackbits cover the complete size range from 1⅜ to 4½ inches. From the many different designs you can select a bit that will give you the best drilling efficiency in any kind of rock. There are bits developed especially for the hardest rock . . . for abrasive or sticky ground . . . for ground that tends to rifle or that binds the bit . . . for ground that requires maximum bit clearance.

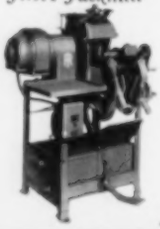
All plants of Ingersoll-Rand Company are flying the Army-Navy "E" awarded "for high achievement in the production of war materials."

2

THE *only* COMPLETE LINE OF RECONDITIONING EQUIPMENT

JMA Jackmill

JF Jack Furnace



J3 Jackbit Grinder

Drill Steel Sharpener

Experiences of hundreds of users show that Jackbits reduce over-all drilling costs. But, as rock drill manufacturers, we know that maximum savings are possible only when you use the right bit for the job and also the most suitable reconditioning equipment. That is why we developed both Grinders and Hotmills for resharpening bits, a Thread Forging Device for forming threads on I-R Sharpeners, a complete line of Furnaces and Accessory Equipment.

3

ROCK DRILLING SPECIALISTS TO ASSIST YOU

We have a number of men who have had wide experience in applying Jackbits to all types of mining and construction jobs all over the country. These men have a thorough background of rock drilling knowledge and are available to help.

Remember, only with JACKBITS do you get these 3 basic essentials of faster and lower-cost drilling

SOLVE YOUR DRILLING PROBLEMS WITH IR JACKBITS

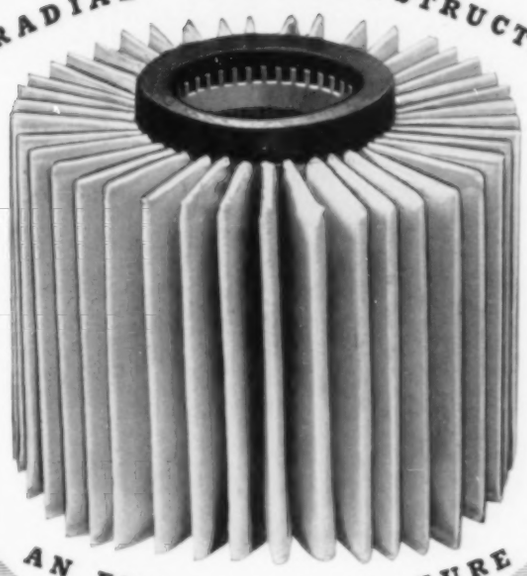
Ingersoll-Rand

11 BROADWAY, NEW YORK CITY

15 225

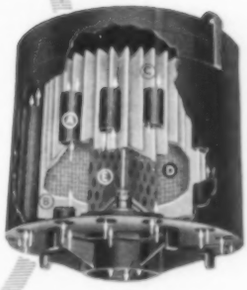
THE HEART OF EVERY PROTECTOMOTOR

RADIAL FIN CONSTRUCTION



AN EXCLUSIVE FEATURE

MODEL D
INTAKE FILTER



MODEL DS
INTAKE
SILENCER FILTER
(Sectional View)

MODEL CPH
AIR LINE
FILTER
(Sectional View)

MODEL CPHLS
LIQUID LINE
FILTER

RADIAL FIN CONSTRUCTION—an exclusive, patented feature found *only in Protectomotor* Air Filters for intake on engines and compressors and for pipe line filtration—has two major advantages: FIRST, it possesses a large area of filtering surface in relation to the overall size of the insert. An insert in the Radial Fin Construction only 11″ high x 8¼″ in diameter has an active filtering surface area of 1325 sq. inches. This means low resistance to air flow, high efficiency and long, maintenance-free life. SECOND, the Radial Fin Construction is the best form ever devised to resist pulsating intake. It has no broad, flat surfaces to break down under the destructive pulsation of a hard-driven internal combustion engine or compressor. Each rigid, wire mesh framed fin opposes an *arch* to the force of inrushing air. Write today for the latest catalog describing Protectomotors in detail. Mention special interests. *Filters also made for ventilation and dust recovery.*

Representatives in Principal Cities

STAYNEW FILTER CORP. "Air Filter Headquarters"

7 Centre Park PROTECTOMOTOR AIR FILTERS **Rochester, N. Y.**

SAVE LABOR
in Preparing Charges

☆

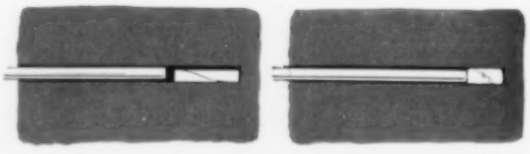
BREAK MATERIAL
for Faster Mucking

You can save labor and time, and get better breakage, with Hercules Tamptite Cartridges. The new design and construction of the paper shell allows the explosive to be tightly packed in the bore hole without slitting the cartridges. There's no spilled powder, even when loading uppers.

The bore hole is filled solidly, with a minimum of air space around the charge. That makes the force of the blast do more useful work. More material is broken, and it is in better shape for mucking.

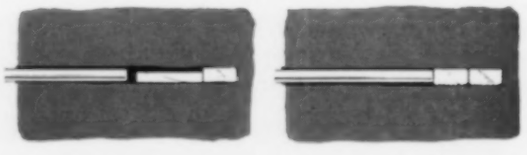
Specify Tamptite Cartridges on your next order for Hercules Explosives.

Here's how TAMPTITE makes efficient Loading easy



1 The regular-size cartridge goes in the bore hole. Note the space to be filled.

2 Pressure from the tamping rod compresses the powder to fill the space.



3 Another cartridge goes in—Compaction takes place inside the wrapper.

4 The charge is concentrated for better blasting results.

HERCULES POWDER COMPANY

INCORPORATED

932 KING STREET • WILMINGTON • DELAWARE

A-90

. . . when valves stay clean

OPERATING on rush war work, your compressors can *still* deliver full capacity . . . when valves are kept carbon-free with *Texaco Alcaid, Algol* or *Ursa Oils.*

Free from elements that form gum, sludge and hard carbon, these Texaco Oils assure clean valves, open ports, longer service between inspections and overhauls.

The outstanding performance that has made Texaco preferred in the fields listed below has made it preferred on prominent construction jobs throughout the country.

These Texaco users enjoy many benefits that can be yours. A Texaco Automotive Engineer will gladly cooperate . . . just phone the nearest of more than 2300 Texaco distributing points in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York, N. Y.

Photo courtesy U. S. Bureau of Reclamation

THEY PREFER TEXACO

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

TEXACO Lubricants and Fuels

FOR ALL CONTRACTORS' EQUIPMENT

TEXACO

TUNE IN FRED ALLEN EVERY SUNDAY NIGHT—CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

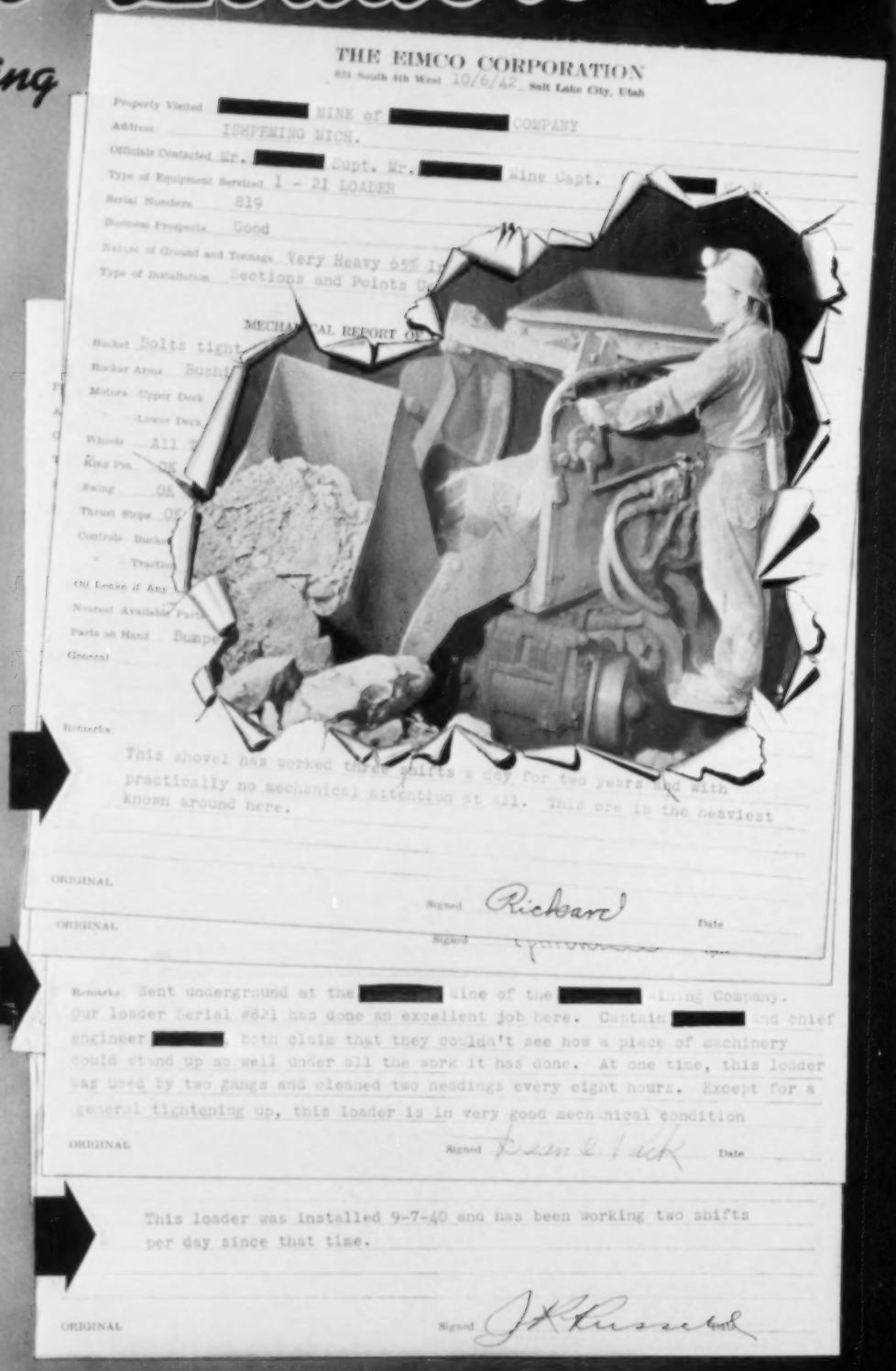
Eimco Loaders +

Eimco Engineering

Whether in the mines of the great iron fields of Minnesota or Alabama; the lead-zinc mines of the Tri-State Area; or in the huge copper mines of Montana or Arizona where hundreds of Eimco Loaders are in action the Eimco Field Engineer can be found — cooperating with Mine Owners, superintendents, shift-bosses and miners to develop operating conditions that will increase production through the use of the EIMCO LOADERS — designing trackage, cherry-pickers, and accumulating data which makes it possible for EIMCO to LEAD THE WAY with new features and designs.

Our Field Engineers know, as witness their reports, that the EIMCO LOADERS can *"take it"* and it is their duty to assist all mine operators in *"dishing it out."*

If you are not getting maximum loading, if underground problems are slowing you down, ASK FOR AN EIMCO FIELD ENGINEER!


THE EIMCO CORPORATION
621 South 4th West 10/6/42 Salt Lake City, Utah
Property Visited [redacted] MINE of [redacted] COMPANY
Address ISHPEMING MICH.
Officials Contacted Mr. [redacted] Supt. Mr. [redacted] Mine Capt.
Type of Equipment Serviced 1 - 21 LOADER
Serial Numbers 819
Business Prospects Good
Nature of Ground and Tonnage Very Heavy 65% Ir
Type of Installation Sections and Points
MECHANICAL REPORT ON
Bucket Bolts tight
Rocker Arms Bushi
Motors Upper Deck
Lower Deck
Wheels All
King Pin OK
Swing OK
Thrust Stops OK
Controls Bucke
Tractio
Oil Lease if Any
Nearest Available Parts
Parts on Hand Bumpe
General
Remarks
This shovel has worked three shifts a day for two years and with practically no mechanical attention at all. This ore is the heaviest known around here.
ORIGINAL
Signed Richard
Date
ORIGINAL
Signed
Date
Remarks Sent underground at the [redacted] Mine of the [redacted] Mining Company. Our loader Serial #821 has done an excellent job here. Captain [redacted] and chief engineer [redacted] both claim that they couldn't see how a piece of machinery could stand up so well under all the work it has done. At one time, this loader was used by two gangs and cleaned two headings every eight hours. Except for a general tightening up, this loader is in very good mechanical condition
ORIGINAL
Signed Sam L Tuck
Date
This loader was installed 9-7-40 and has been working two shifts per day since that time.
ORIGINAL
Signed J. K. Russell

EIMCO MANUFACTURES FOUR DISTINCT TYPES OF LOADERS, EACH WITH A FULL RANGE OF BUCKET DISCHARGE HEIGHTS, HEADROOM HEIGHTS, AND TRACK GAUGES.

THE EIMCO CORPORATION

SALT LAKE CITY, UTAH, U.S.A.

NEW YORK	CHICAGO,	EL PASO	SACRAMENTO
120 Broadway	111 W. Washington St.	Mills Bldg.	1217 7th St.

The American Tiger Brand Army is on the march

FOR CONSTRUCTION Check over in your mind the important equipment that requires wire rope for its operation—shovels, draglines, cranes, derricks, scrapers, to mention a few. Then think of the vital part such equipment is playing right now in the construction of war-time facilities. This means that good wire rope like American Tiger Brand is indispensable for the success of our war program.

FOR MINING Because of its strength and superior fatigue-resisting properties, American Tiger Brand Wire Rope will improve operations wherever used. On the mechanized equipment used in mining, where ropes are handled frequently, overwind on drums, bend around small sheaves and are subject to excessive loads under adverse conditions, this rope gives long and trouble-free service.

FOR OIL AND GAS No one needs to tell an oil man how important good wire lines are in keeping his drilling operations running smoothly. In American Tiger Brand Wire Lines, we produce wire lines that have earned their high reputation in the oil fields by actual performance—on a proved ability to meet every demand put upon them as oil wells go down deeper and faster than ever before.

★ *INVEST FOR VICTORY* ★

Buy War Savings Bonds and Stamps

Indispensable to America's War Effort . . .

GOOD WIRE ROPE!

TAKE CARE OF WHAT YOU HAVE, USE IT PROPERLY AND MAKE IT LAST LONGER. We believe this advice is important to every user of Wire Rope. We have prepared a 48-page booklet of Valuable Facts on Wire Rope Care that will improve performance and definitely extend its useful life. A copy in the hands of your operating men will save money for you and, in addition, will help conserve wire rope supplies for other vital national requirements. Send for your copy. *Remember, a broken rope is a break for the enemy.*

AMERICAN STEEL & WIRE COMPANY
Cleveland, Chicago and New York

COLUMBIA STEEL COMPANY
San Francisco

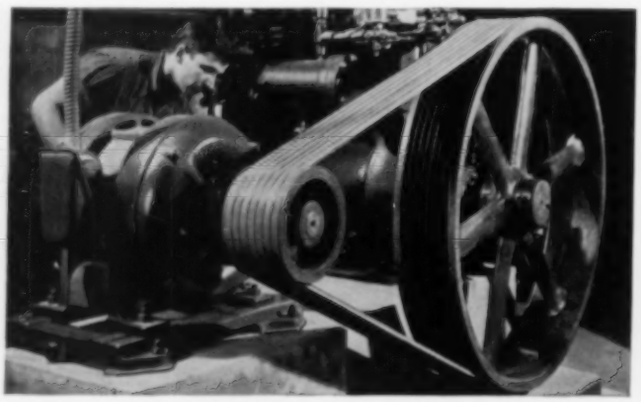
United States Steel Export Company, New York

Excellay Preformed

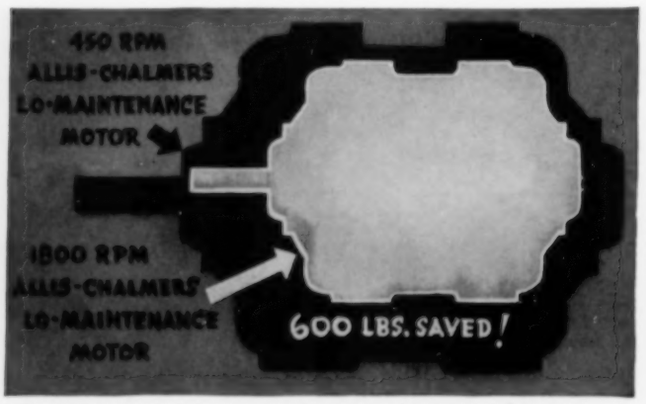
UNITED STATES STEEL

It's Time to Look at Motor

➔*You Can Save with High-Speed Instead of*

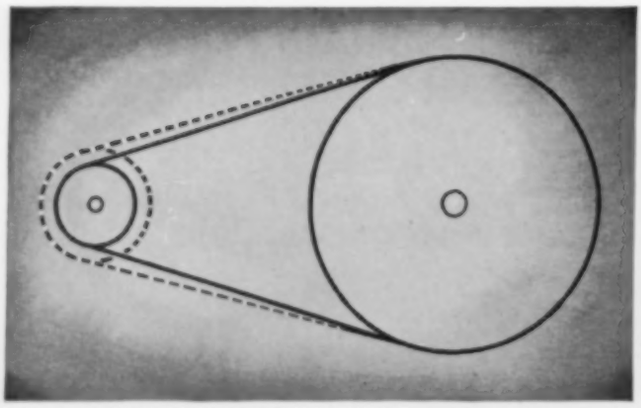


1. In most applications, an 1800 rpm motor with Texrope Drive will ably do the job of a lower-speed, direct-connected motor . . . *and* give you *exactly* the speed you want — *at lower cost!*

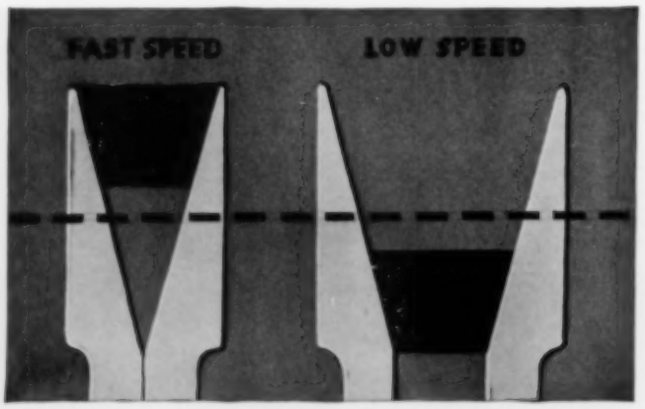


2. When you buy an 1800 rpm instead of 450 rpm 15 hp squirrel-cage motor, for example, 600 lb of critical materials are saved. And *you* save well over $200—with the drive figured in! This saving is typical.

➔*You Can Save with Single-Speed Instead of*



1. Infrequently needed speed changes can be had by changing from one size motor sheave to another. By juggling *complete* drives, speeds can be changed over the full range — from 1:1 to 7:1.

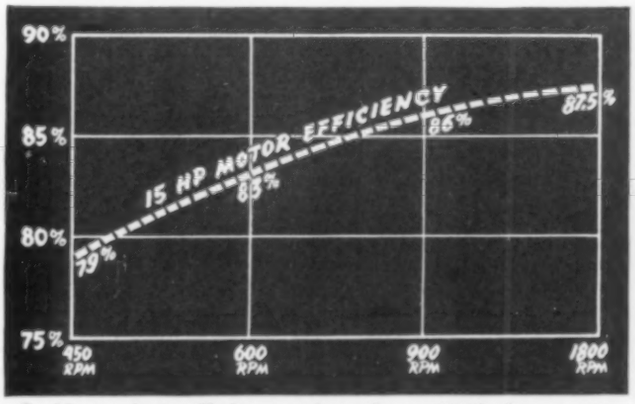


2. With the Allis-Chalmers Vari-Pitch Sheave, you can increase or decrease speed by adjusting sheave diameter, as above. Within limits, an unbroken series of speeds can be obtained.

Take a Fresh Buying!

WAR FORCES HIGHER EFFICIENCIES...

Low-Speed Motors...



3. Note that efficiency rises from 79% for a 450 rpm motor to 87.5% for a 1800 rpm motor. Comparing power consumption, the 1800 rpm motor saves you over 30 kw/24 hr. day.

Multi-Speed Motors...

3. Allis-Chalmers Vari-Pitch Speed Changer gives you infinite changes at the turn of a wheel — within 3.75 to 1. It's the most compact, flexible variable-speed transmission available.

It was good business in peacetime to use — as widely as possible — high-speed motors with Allis-Chalmers Texrope Drives...and single-speed motors with Allis-Chalmers Vari-Pitch Sheaves and Speed-Changers. And it's clearer every day that those material and money-saving practices are *vital* practices in time of war!

TODAY the whole picture of buying and applying motors has changed. Note at the left how much you can save for your country *and yourself* with high and single-speed motors made flexible by Texrope Drives.

As America's only builder of both electric motors and V-belt drives,* Allis-Chalmers has long advocated the proper combining of motor and V-belt drive.

And today you benefit from Allis-Chalmers' vast, pioneering experience in this field when you ask for and get the *right* combination of Lo-Maintenance Motor and Texrope Drive! Call your nearby district office. Or write ALLIS-CHALMERS MFG. CO. MILWAUKEE, WISCONSIN.

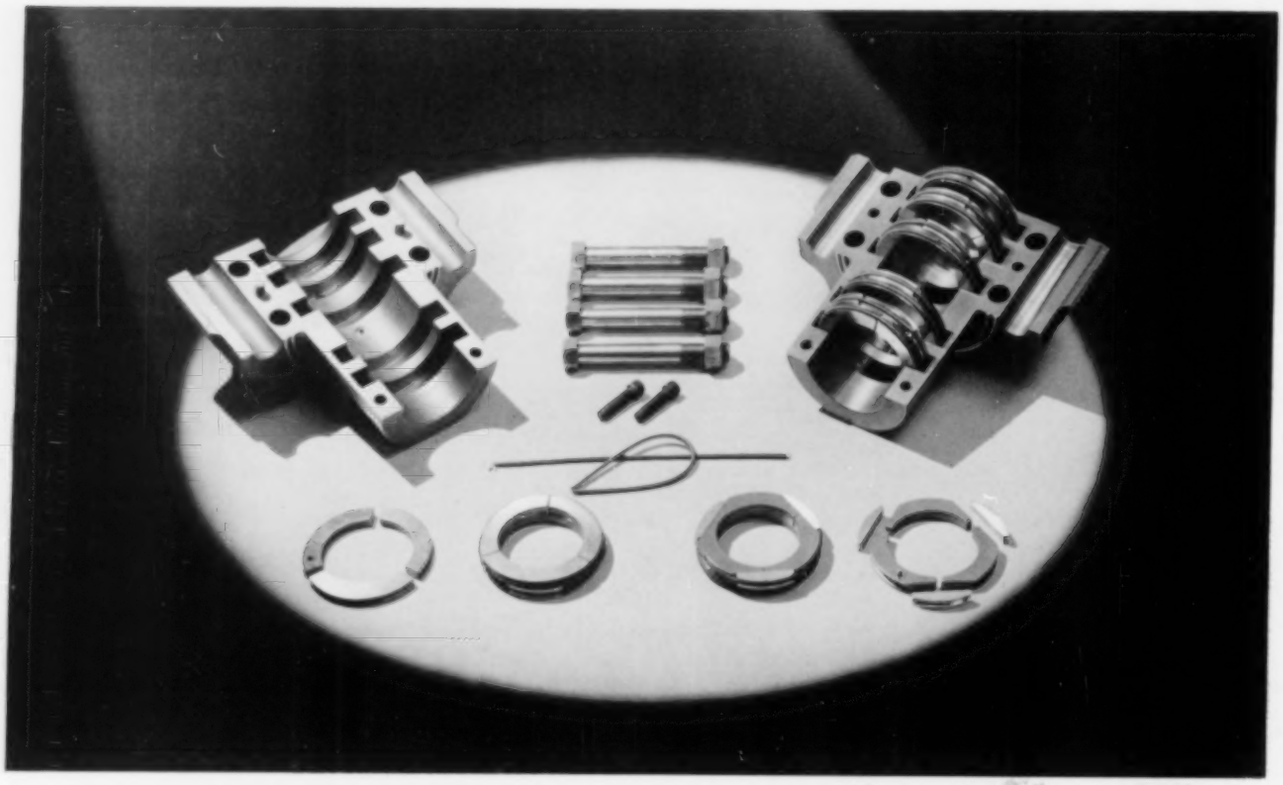
A 1560

*Allis-Chalmers *originated* the Multiple V-Belt Drive and Vari-Pitch Sheaves.

ALLIS-CHALMERS A-C MILWAUKEE

WE WORK FOR VICTORY WE PLAN FOR PEACE

PRECISION METALLIC ROD PACKINGS



(Unretouched Photo)

Split Case Type for application without disconnecting the Rods of Engines and Compressors

YOUR engine or compressor will deliver more horsepower at less cost if its rods are equipped with COOK'S Metallic Packings. And the reasons why are summed up in the following features of COOK'S Packings:

Precision construction assures positive seal of pressure.

Packing rings "float" in self-contained casings which allows for rod misalignment and vibration, avoiding the extra friction and wear that would otherwise result.

Packing rings are made of anti-friction metals and designed to compensate for wear automatically.

Design also provides a constant oil film between packing rings and rod, eliminating metal to metal friction.

COOK'S Packings reduce friction to a mere fraction, become a permanent part of the machine and render years of service without repairs.

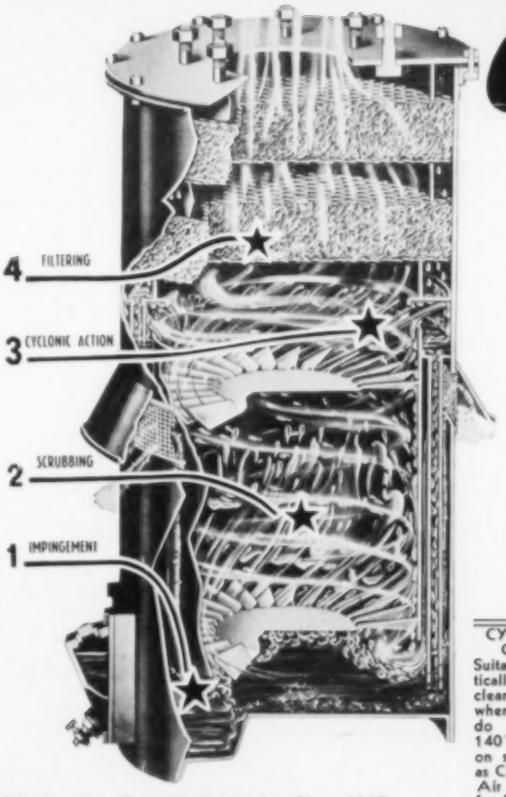
Recognizing these advantages many engine and compressor manufacturers supply COOK'S Packings as original equipment; others furnish them on request. There is a proved COOK'S Packing for all prevailing pressures and temperatures in annular cup, split case and other special designs. Here is illustrated a split case packing developed for application without disconnecting the rod.

When ordering new equipment specify COOK'S Metallic Packings. For equipment in service, write us direct or our nearest office.

C. LEE COOK MANUFACTURING CO., Incorporated, Louisville, Kentucky. Branch offices and representatives—Baltimore, Boston, Chicago, Cleveland, Houston, Los Angeles, New Orleans, New York, Mobile, Montreal, Portland, Ore., San Francisco, Seattle, Tulsa.

"Sealing Pressures Since 1888"

COOK'S METALLIC PACKINGS



Cycoil CLEANERS WILL KEEP YOUR ENGINES AND COMPRESSORS RUNNING LONGER

Around-the-clock war production schedules are working power plants far beyond their normal capacities which makes it all the more necessary to protect precious engines and compressors from excessive wear and breakdowns due to dust.

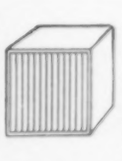
In dollar outlay, air cleaners are still a small factor in any engine setup, but their importance to the life of your engines or compressors makes it all the more necessary to choose the type of air cleaner that will render the very best possible service.

AMERICAN AIR FILTER CO., INC.
INCORPORATED
402 Central Avenue, Louisville, Kentucky.
In Canada: Darling Bros., Ltd., Montreal, P. Q.

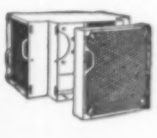
Write for Cycoil Bulletin No. 130D which gives complete information on its operation.

CYCOIL GAS CLEANER
Suitable for practically every gas cleaning problem when temperatures do not exceed 140°F. Operates on same principle as Cycoil Oil Bath Air Cleaner. Ask for Bulletin 130D.

PL-H FILTER
is a complete assembly consisting of housing, ready to bolt to intake pipe, and dry cell type filters in which wool felt constitutes the filter medium. Ask for Bulletin 120D.



TYPE OCH FILTER
Complete assembly consisting of washable viscous impingement type filters. 1, 2, 3, or more cells are used, depending upon size of cleaning job. Ask for Bulletin 120D.



AMERICAN Cycoil AIR and GAS CLEANERS

Air Bases and Military Highways

"In the past 17 years this 38-V is the very best that I have had," says Harry Pickett, Allegan, Mich., road contractor. His two Pioneer Model 38-V Duplex portable crushing-screening plants are powered with Waukesha Engines.

★Air bases; runways, taxi strips and aprons for flying-fields; docks; access roads; military highways — are urgently needed for our armed forces everywhere.

And that takes aggregate—tons and tons of it!

To supply it *quickly*, Uncle Sam is getting the current production of these portable Pioneer crushing-screening plants—many of them with Waukesha Super-Duty Power Units.

Contractor Harry Pickett gets real output — 100 to 110 cu. yds. of minus ¾" per hr. *consistently* with his portable Pioneer plant. Its Waukesha Oil Engine Power Unit drives the 1036 jaw crusher, 3018 roll crusher, 3'x10' 3½-deck vibrating screen and conveyors smoothly *and* effortlessly—with plenty of power in reserve for emergencies.

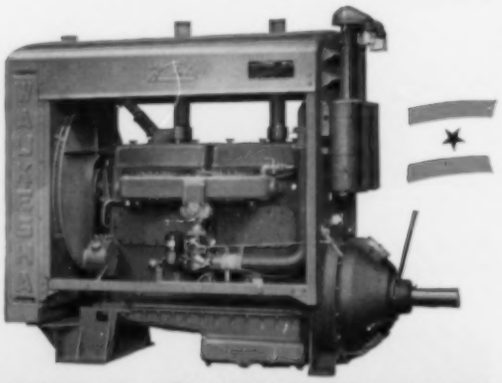
In addition to large capacity, the Waukesha Engine, with its moderate weight, gives the plant extra portability.

And by users' performance records, Waukesha Engines give *the greatest overall economy*. Get Bulletin 1079.

WAUKESHA MOTOR COMPANY, WAUKESHA, WIS.
NEW YORK TULSA LOS ANGELES

MORE POWER FOR VICTORY

Model 6-WAKU Waukesha Super-Duty Industrial Engine

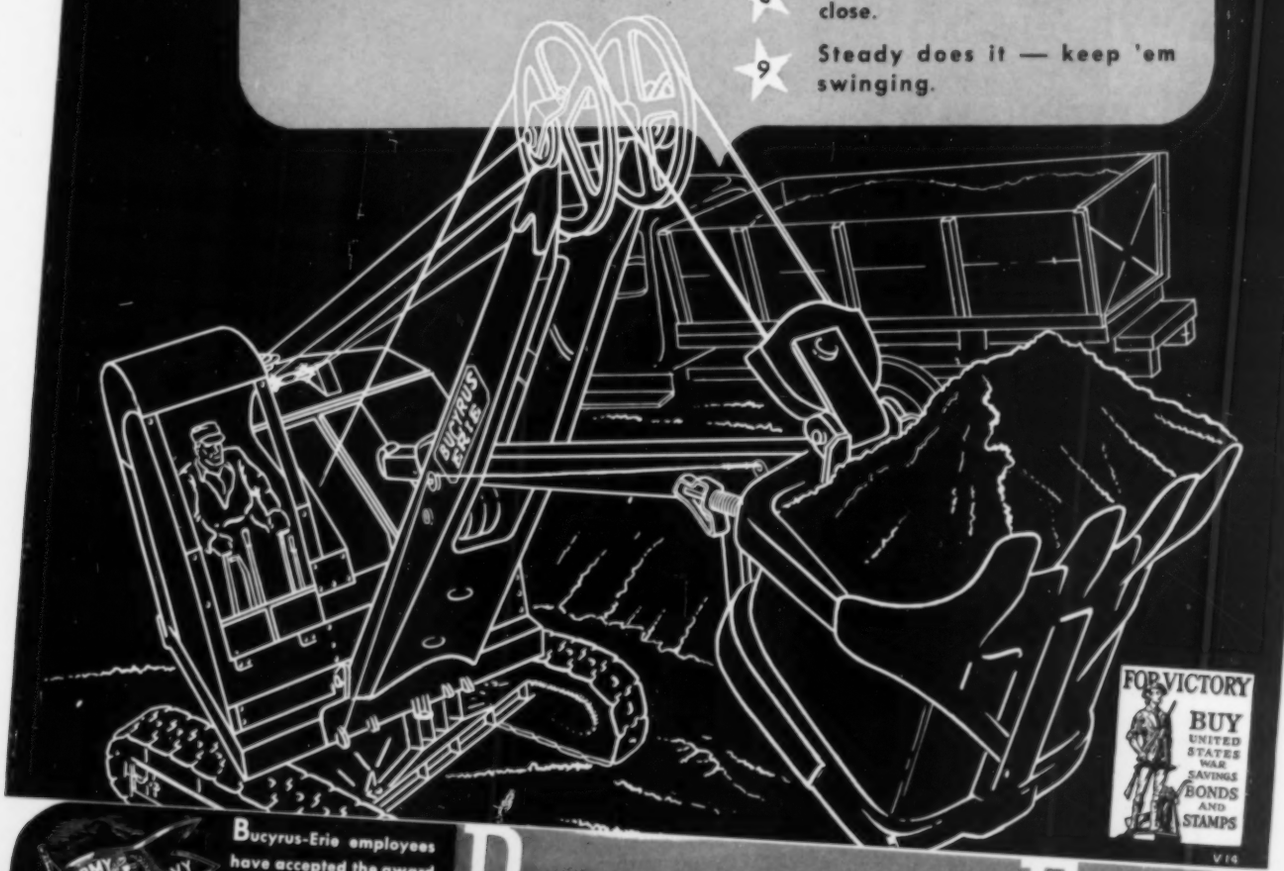


WAUKESHA ENGINES

SWING IT for VICTORY

The output of any shovel depends on the operator's "know how." Check your shovel performance with the list below and perhaps you'll find a point or two that will help. We all want to win this war the quick way . . . let's go!

1. Keep the swing short . . . spot trucks in close.
2. Cut a thin slice up along face so the dipper comes up fast and easy. Don't overcrowd!
3. Keep dipper teeth sharp.
4. Set pitch braces for fast digging. Angle of teeth should usually match average angle of bank.
5. Keep your friction clutches right. You can't dig fast with a sloppy clutch adjustment.
6. Loosen the bank while you wait for trucks.
7. Overlap your cycle . . . have dipper at right height for dumping when it swings over truck; swing and lower; come in crowding.
8. Move up often, work your bank close.
9. Steady does it — keep 'em swinging.



FOR VICTORY BUY UNITED STATES WAR SAVINGS BONDS AND STAMPS

V-14

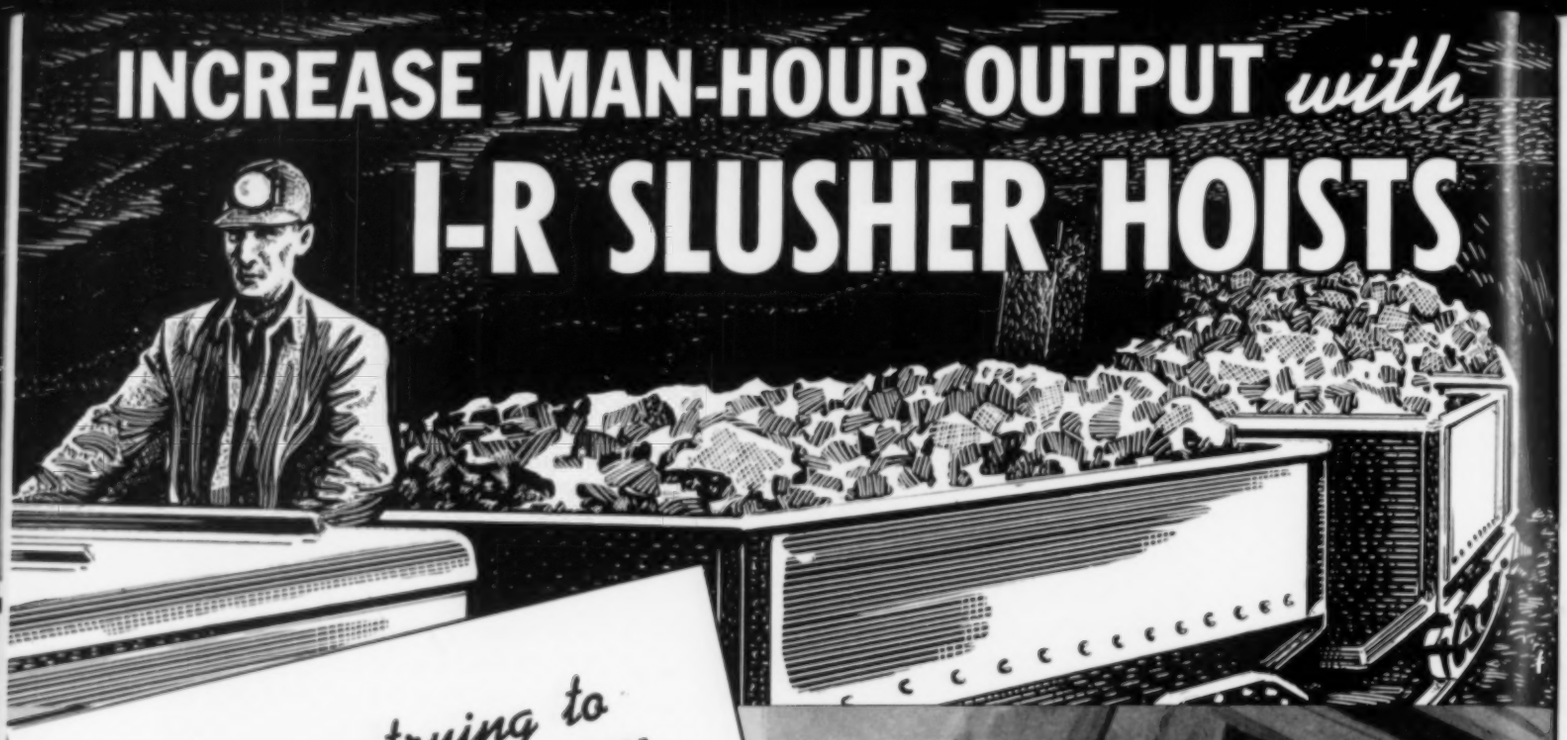
ARMY E NAVY

Bucyrus-Erie employees have accepted the award of the Army-Navy "E" as a challenge to keep production rising. ★ ★

Bucyrus-Erie

SOUTH MILWAUKEE • WISCONSIN • U. S. A.

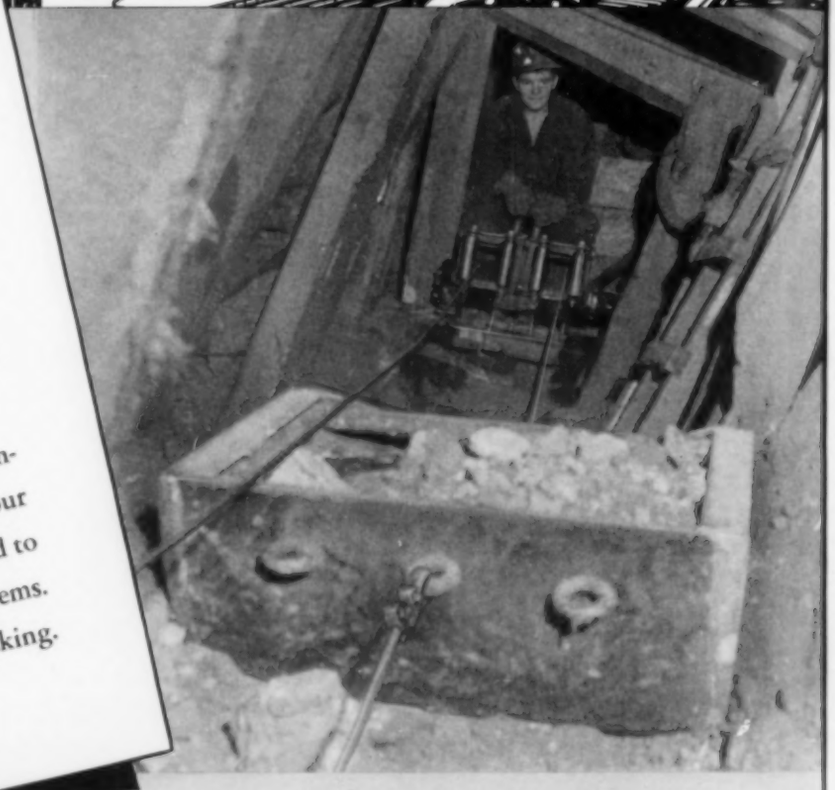
INCREASE MAN-HOUR OUTPUT *with* I-R SLUSHER HOISTS

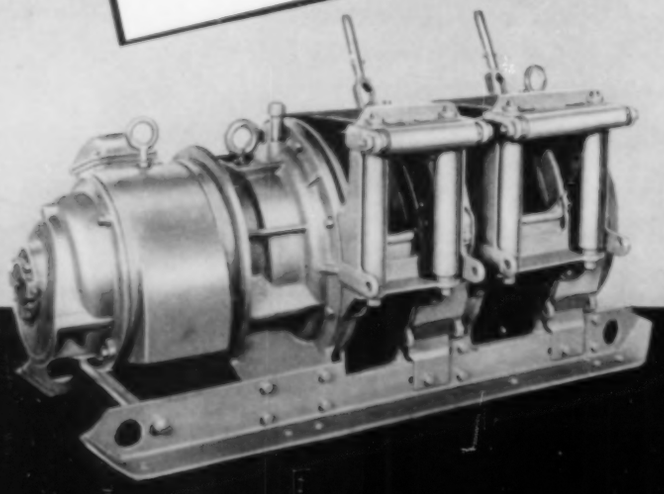


Are you trying to KEEP UP TONNAGE WITH REDUCED MANPOWER?

Many mining sections are experiencing a labor shortage. As the war progresses, this shortage will become more acute. Yet the demand for vital ores will continue to increase. To meet this situation, many properties have added or installed Ingersoll-Rand Slusher Hoists.

It is possible that your tonnage can be considerably increased by a slight change in your setup. An I-R Service Engineer will be glad to help analyze your specific mucking problems. This friendly service is yours for the asking. Consult our nearest branch office.





I-R SLUSHER HOISTS INCLUDE A SIZE FOR ANY TYPE OF MUCKING WORK

Air or Electric drive . . Many Sizes and types
Sturdy construction . Low Maintenance Costs
Trouble-free service . . . . . Portability

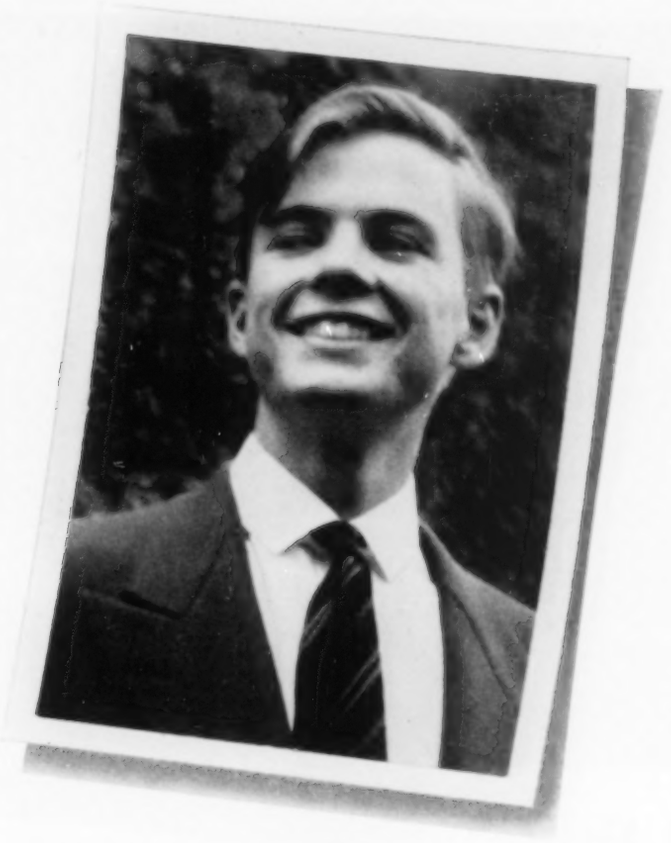
ARMY E NAVY

Ingersoll-Rand and its employees are proud of the Army-Navy "E" awarded to its Athens Plant for high achievement in supplying essential war equipment.

Ingersoll-Rand

8-215 11 BROADWAY, NEW YORK, N. Y.

Son...



HE has just turned eighteen. Shaves twice a week and maybe a hair or two is sprouting on his chest. He shies away now when his dad tries to be affectionate and we noticed some lipstick on one of his handkerchiefs after a country club junior dance not so long ago. But it seems only yesterday, perhaps it was the day before, that he was a chubby legged kid swinging from the arch of the doorway, leading to the dining room, in a gadget that was something like a breeches buoy and he was sucking at the end of a turkey bone.

He went back to school this Fall, a tall, athletic lad, budding into manhood, but there was something else on his mind beside the football and hockey teams or the little blonde girl with whom he had "palled" around during the Summer. It seems as though he was listening for a certain call—the Clarion call that poets sing about—and, perhaps we just imagined it, but we thought we saw an upward jutting of his chin, a certain light in his eyes, and a sort of a rearing-to-go expression in his face.

It chilled us a bit in the region of our heart, when we thought of his discarding the sports coat for the "O.D." of the Army or the blue of the Navy. There was a bit of a catch in our throat as we thought of his putting aside his football helmet for one of steel; of his hanging up his hockey stick and reaching for a gun. After all we still regard him as just a little boy.

They tell us that the eighteen and nineteen year old lads are to be called to the service. When that day comes to us there will be prayers, but no tears. We shall not mourn nor shall we be fearful. Rather there will come welling up from our hearts that warm feeling of pride that millions of other parents will sense when their beloved lads marched away. Our lad is no different than the others. We are no different than other loving parents, nor is our sacrifice any greater. They are going to make great soldiers, sailors, marines and fliers out of these youngsters. And they will become a mighty force when they take their places beside their brothers in arms. They too know what they fight for. They too know full well of the sacrifices that must be made before the evil powers that threaten the world can be overcome.

And let us not forget that they are counting on us. They know that we shall not fail them.

God be with them and their brothers.

THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.

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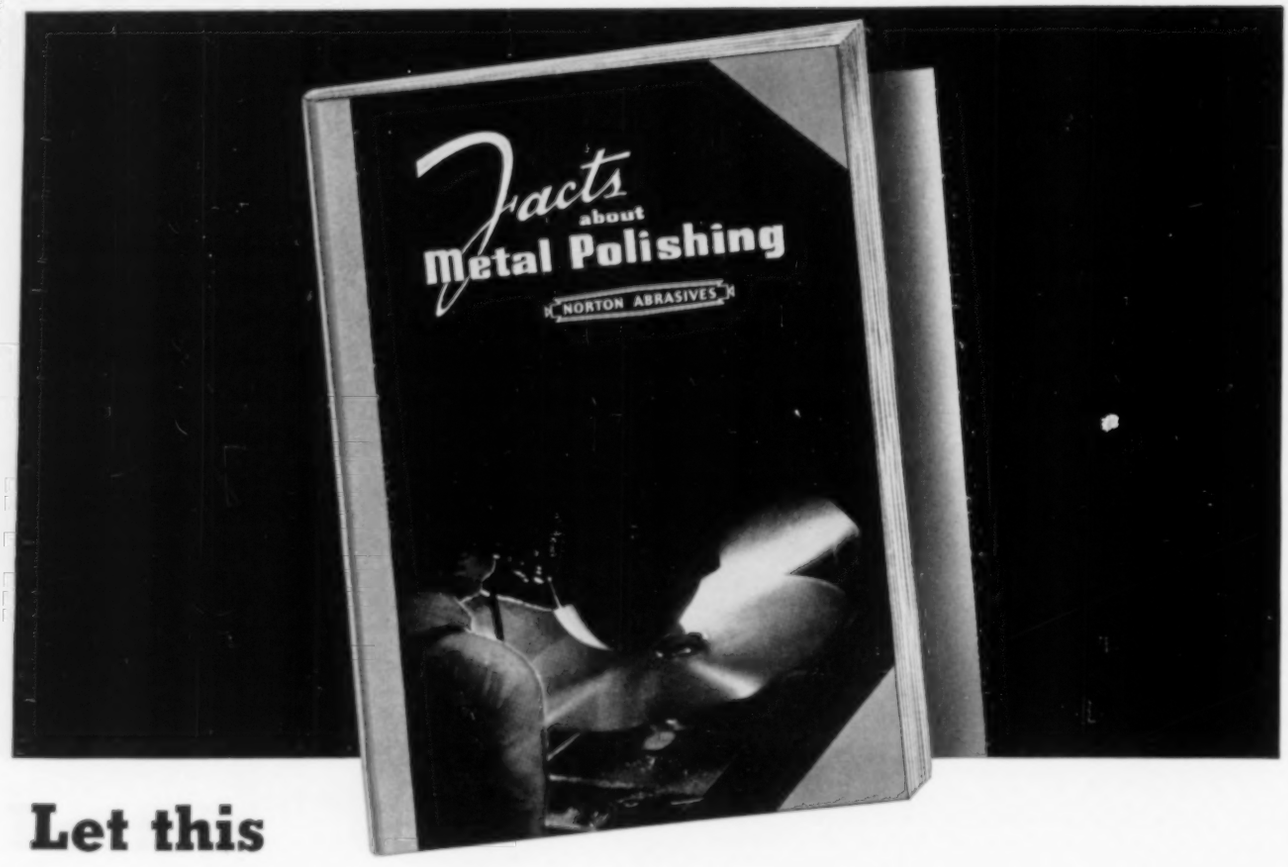

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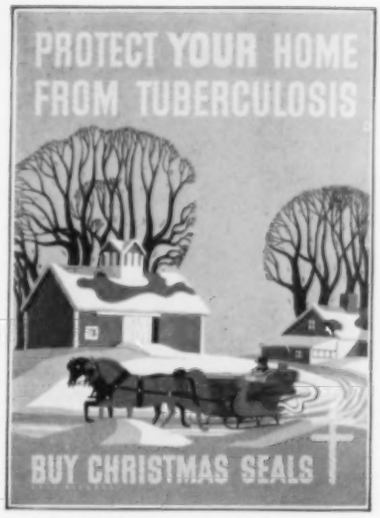

ON THE COVER

OUR cover picture shows a satin pillow case that was made by what the trade calls trapunto work. The design is first drawn upon paper, and then the outlines are perforated. This pattern serves as a stencil in transferring the design to the cloth. Next, the satin and the cloth backing are stitched together along the lines of the motif. The spaces between the two layers of cloth within the limits of the pattern are then filled with cotton thread, thus puffing up or embossing the design. The thread is fed through a needle and blown into the openings by means of compressed air at 60 pounds pressure. For this operation the air is conveyed through a small rubber hose extending from an air compressor. The workman controls the air flow by means of a foot-operated valve.

The photograph, which won a prize in our 1942 cover contest, was submitted by Arthur Wolf of Chicago. Mr. Wolf is a designer for the Madison Embroidery Company and states that trapunto work is used to embellish ladies' dresses and coats, millinery, pocketbooks, and other articles.

•

IN THIS ISSUE

MICA, which is the subject of our leading article, is needed in many types of fighting equipment. The average war plane, for example, contains 15 pounds of it. Ordinarily dependent upon foreign sources for strategic grades of mica, our nation is fast developing an adequate domestic supply.

•

CREEDE, Colorado, a revivified mining camp that boomed in the heyday of silver, is portrayed in five pages of pictures with brief accompanying text.

•

A PREVIOUS article in our pages led a western coal-mining company to build a successful underground air receiver that is described in this issue.

Compressed Air Magazine

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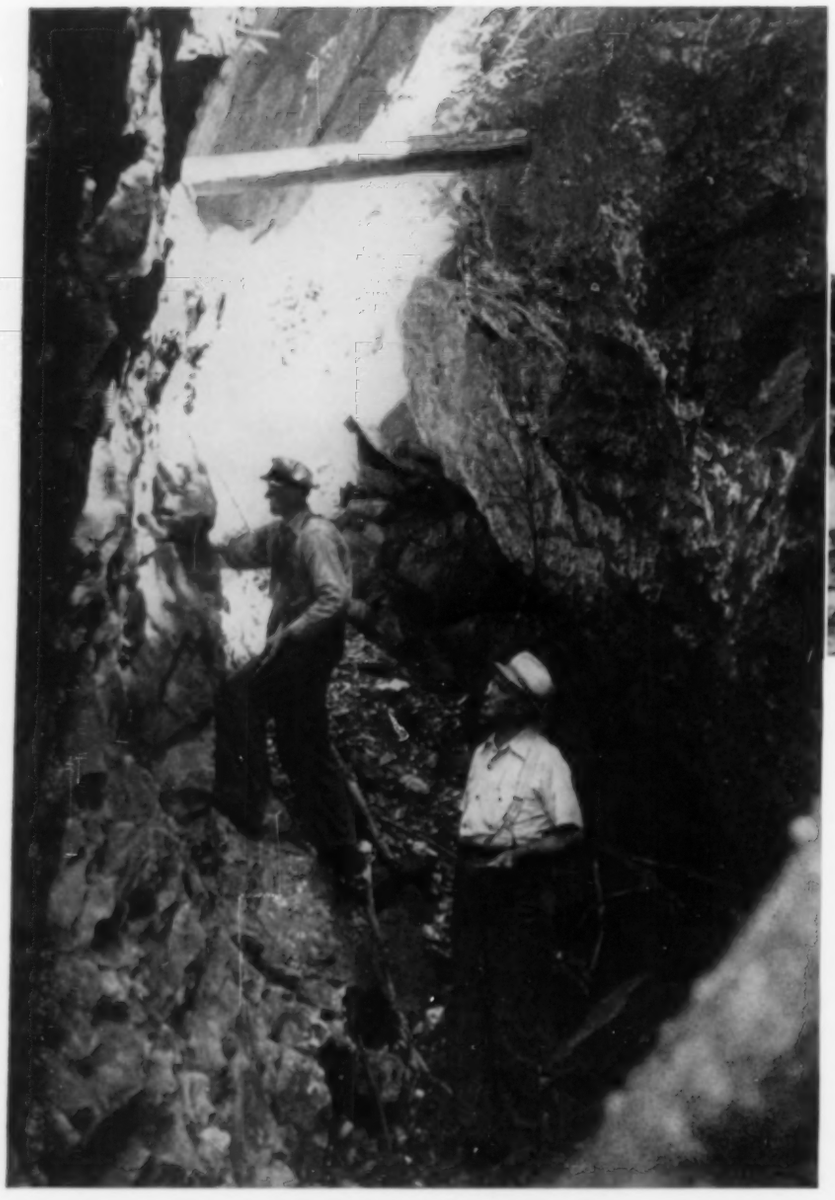
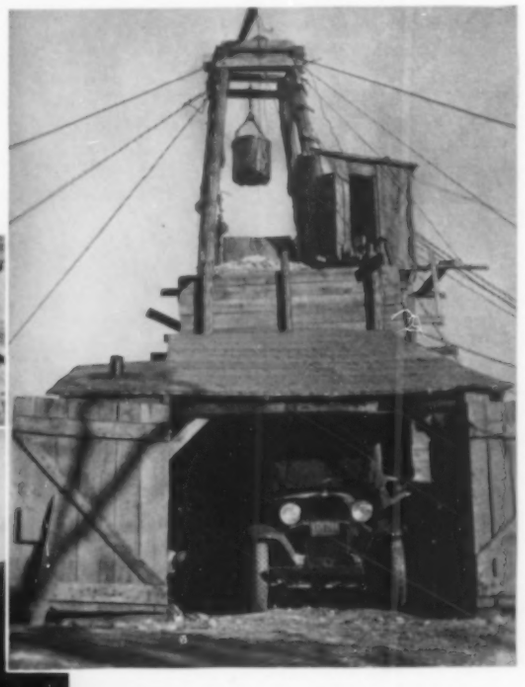
Strategic Mica

C. H. Vivian



AS A RESULT of the sharply increased demand for mica for war purposes, coupled with a falling off of imports, mica mining has been greatly stimulated in this country, especially in North Carolina which has been the leading domestic source of the mineral for many years. More than 250 properties in the area around Spruce Pine, in the northwestern section of the state, are now producing mica. The operations are of varying sizes, but most of them are comparatively small because the nature of the mineralization usually does not favor large-scale development. The quantity of mica that is coming from the ground cannot be revealed, but it can be stated that it is growing greater month by month and that the October output was larger than that for any similar period, including the peak month of the World War I era, when mica was also eagerly sought.

Mica is one of three nonmetallic minerals now listed as strategic materials, the two others being iodine and quartz crystals. Around the turn of the century, and for some years thereafter, mica was chiefly utilized to make windows for heating stoves and chimneys for kerosene lamps. It was familiarly called isinglass because of its resemblance to the true isinglass, which is a gelatinous substance. It was well suited for the services mentioned by reason of the transparency, toughness, and flexibility of thin sheets of it, and because of the great resistance of the latter to heat and temperature changes. Some of these same properties, plus its almost complete resistance to the conductivity of electric current, have since made mica a vital material in many types of electrical machines and appliances where it serves chiefly as an insulating agent. All radio tubes contain a mica spacer and a mica bridge, and the familiar electric toaster in your kitchen has mica plates, as has the



VIEWS IN MICALAND

Pictures from western North Carolina, where 2,500 men are mining mica and preparing it for market. At the extreme left is a typical working and its steep dip, showing the narrowness of the pegmatite dike in which mica is found. In the center view is block mica as it comes from the ground, after which it has to be divided into thin sheets and trimmed to eliminate impurities. The material illustrated all came from one blast and is an unusually good lot. The headframe of the Deer Park Mine, an old property recently brought back into production, is seen below. At the top of the structure is one of the cylindrical buckets or cans that are generally used for hoisting mica. This mine is the deepest in the district (435 feet), and its shaft is served by an electric hoist. By far the greater proportion of all mica mined is unsuitable for sheeting and is prepared for use in ground form. The English Mica Company operates four grinding mills, one of which is pictured below, at the left. This concern has developed a method of grinding mica so fine that it would pass through a screen having 3,000 openings to the square inch, if such a screen existed.

common fuse plug. A thin wrapping of mica surrounds the spindle of each spark plug in airplane motors and the core of the plug is built up of mica washers. Electric motors, generators, and condensers, including those in radio receiving sets, make use of mica on account of its dielectric strength (capacity to resist breakdown under high voltage). Ground mica enters into the manufacture of paint, rubber, asphalt shingles, and wallpaper and is sprinkled on asphalt roofing to prevent sticking of the material when rolled. It has been found to be superior to talc for this purpose. Finely divided mica also serves as "snow" for decorating Christmas trees and gives sparkle to theatrical settings, costumes, and trinkets.

Mineralogically speaking, mica is a unique material. It is characterized by an almost perfect cleavage in one direction and by the thinness of the elastic plates or laminae into which this cleavage permits it to be split. It is a fairly common rock-making mineral, and accounts for the fact that granite glistens. In some schists it is so prominent that they are classified as mica schists. In these rocks, however, the particles are so small that they are suitable only for grinding. Sheet mica, up to 48 square inches in surface area, is chiefly obtained from coarse, crystalline pegmatite dikes intruded into granite, gneiss, or schist. It is commonly found in association with the feldspar of the pegmatite, and some mines produce both feldspar and mica. But right now the emphasis is on mica.

Mica gets its name from the Latin and means a grain; but another Latin word, *micare*—to glitter—likewise has left its imprint upon it. The German word for mica is *Glimmer*, which also means to glitter. There are three common varieties, all of them being aluminum silicates but varying as to their other constituents. Muscovite, the clear, almost colorless kind that commands the highest price, contains potassium. Phlogopite, which is commonly amber or brown because of the presence of a small amount of iron, contains potassium and magnesium. Biotite is similar in composition to phlogopite, except that it contains more iron which gives it a jet-black color and makes it unsuitable for many purposes.

The micas rank between 2 and 3 in the

mineralogical scale of hardness, being soft enough to be marked with a fingernail. Muscovite is the preferred variety and the only one that can be used in condensers and for certain other services. It is found in eastern India, close to Japanese-occupied Burma, and is mined in this country in North Carolina, Connecticut, New Hampshire, Georgia, South Dakota, and in several other states. It is also produced in Brazil and Argentina, as well as in Russia, where it acquired the name "Muscovy glass" from the fact that it served to make lantern and lamp chimneys. Most commercial phlogopite or amber mica comes from Canada, Madagascar, and Mexico. Although it is not so desirable as muscovite, it has many strategic applications. Biotite is unsuitable for electrical work because of its relatively high iron content and is sold principally in ground form.

Muscovite and phlogopite reach the market in four forms:

1—Sheets or blocks ranging in size from 1½x2 inches to 8x10 inches and not less than 0.01 inch thick. In the United States sheets are classified according to the largest standard rectangle that can be obtained from them.

2—Splittings. These are small sheets, usually less than 3x4 inches square and from 0.001 to 0.0012 inch thick. They are obtained chiefly from material that is too small for block mica.

3—Punch. This is sheet mica generally less than 1½x2 inches in size. Circle mica is similar to punch mica, only smaller.

4—Scrap. Material of irregular size or formation suitable only for grinding.

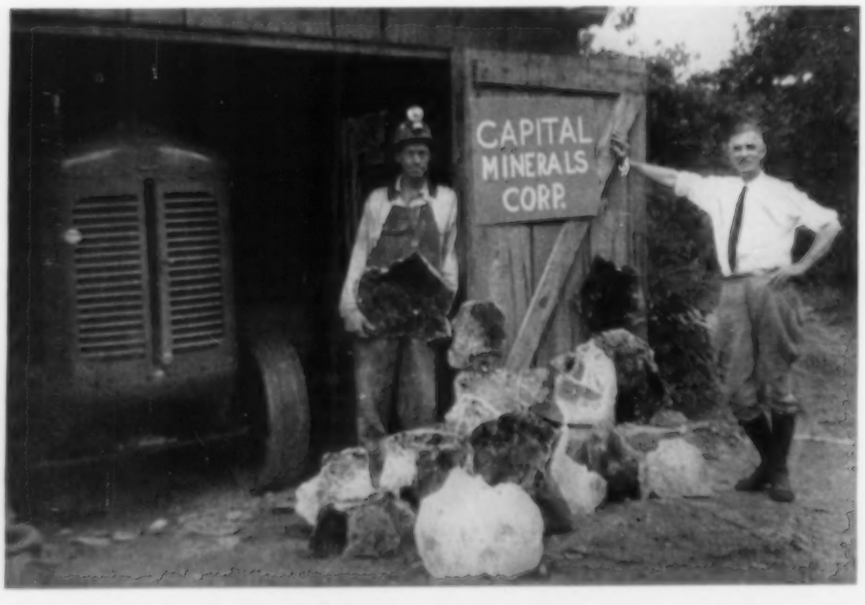
Ordinarily, from 75 to 80 per cent of a mine's output will be scrap, from 10 to 15 per cent will be of sheet grade, and from 10 to 15 per cent of punch or circle grade. Of the total sheet, from 50 to 70 per cent will trim to sizes no larger than 1½x2 inches. Rarely more than 10 to 13 per cent will yield sizes bigger than 3x4 inches, and of this a considerable portion may be stained and, consequently, unsuitable for many purposes.

Ground mica is of two types—wet ground and dry ground, and the former brings the higher price. In 1940 more than $1,000,000 worth of ground mica was produced in the United States. About two-thirds of it went into roofing, 10 per cent into wallpaper, 7 per cent into paints, 6 per cent into rubber as a substitute for zinc oxide, and 11 per cent into miscellaneous products such as molded electrical insulation, house insulation, Christmas-tree snow, axle grease and oil, annealing material, pipe-line enamel, plastic specialties, textiles, coatings for levee mattresses, etc. All ground mica was formerly made from mine scrap and from the material trimmed from pattern mica, but in recent years approximately 40 per cent of it has been obtained by washing kaolin and cyanite as well as by milling chlorite, sericite, and mica schists.

The first mica produced by white men in the United States (Indian mounds have disclosed that red men knew the mineral and used it for fashioning articles of personal adornment) was dug in New Hampshire in 1803 and was made into stove windows and lamp chimneys. Deposits were soon opened in several other states, and domestic sources supplied virtually all the nation's needs until 1885 when the first mica was imported from India. Except for a few years, North Carolina has been the leading domestic producer since records have been kept. In 1940, the United States output was valued at $1,622,828. In addition, we consumed $1,725,522 worth of imported mica, chiefly splittings, most of which came from India, with Canada and Madagascar contributing smaller amounts. Current consumption of high-grade sheet mica is several times higher than any previously recorded and is increasing rapidly because of the great growth in the use of electronic devices in which mica is indispensable.

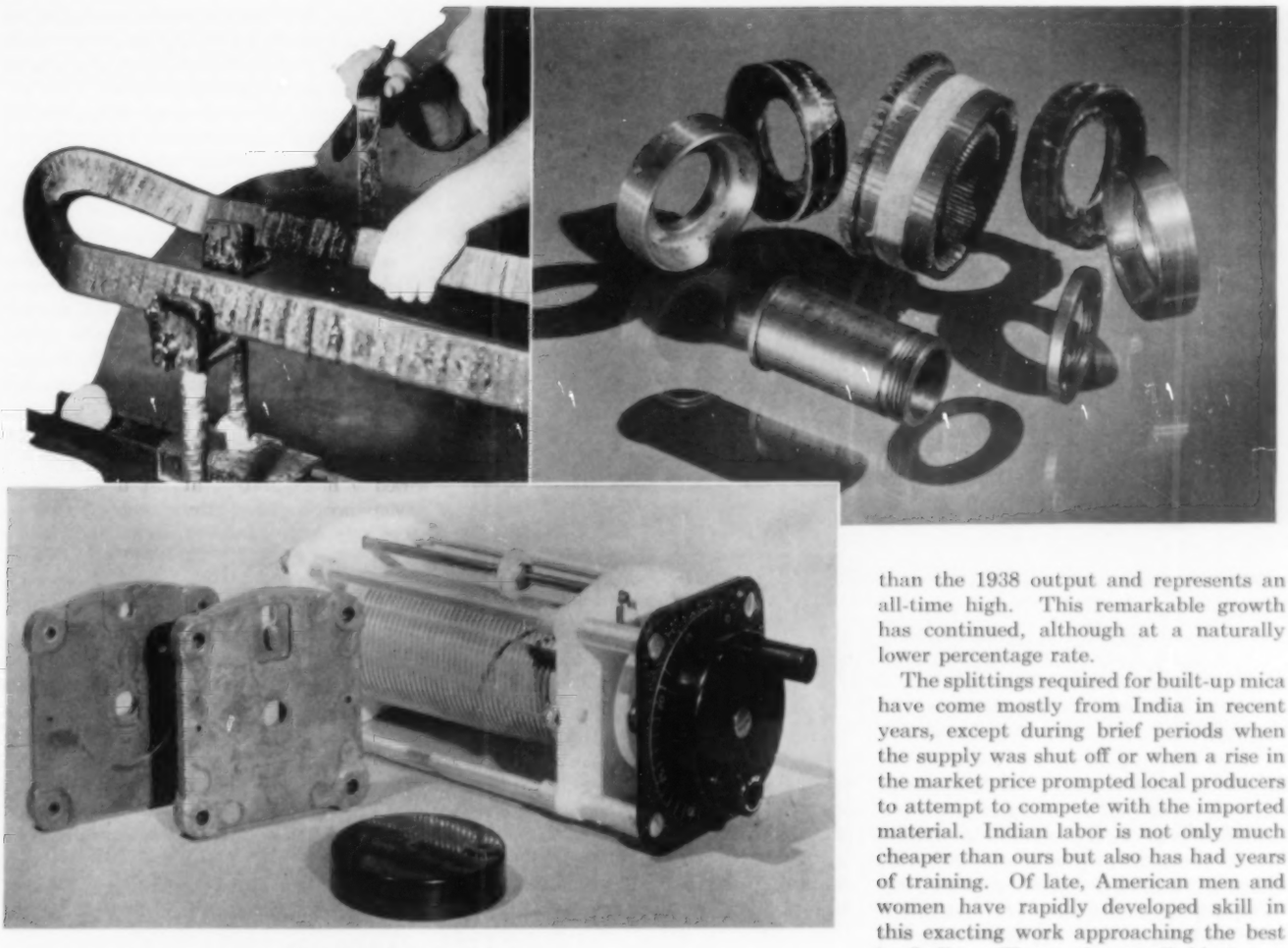
Repeated but unsuccessful efforts have been made to develop a wholly satisfactory substitute for mica. During World War I, Germany tried desperately to accomplish this, but the reward for her pains was failure. A synthetic paper product, called Pertinex, served well in electrical equipment using low voltages but was unsuitable for high voltages. Considerable work has recently been done in this country on a substitute named Alsifilm which is made from bentonite, a form of clay. This material was discovered by Ernst A. Hauser, professor of chemistry at Massachusetts Institute of Technology, and has been sponsored by the Research Corporation of Boston, Mass. Thin films of it are produced either by centrifuging colloidal bentonite from the water in which it is suspended or by drying it on brass plates. Thicker sheets are built up from these films and are made into commutator rings and other shapes that are reported to have been used successfully in a few small motors and generators. Another material, known as Watsonite after its inventor Charles E. Watson, also of Boston, is hardly a substitute but, rather, a different way of preparing mica for service. He takes muscovite mica and applies it to paper, cambric, or other tapes with flexible binders, or molds the mineral into rigid shapes by means of an inorganic binder. Such coatings or shapes are claimed to be superior to ordinary mica products not only in dielectric properties but also in physical strength.

Most of the early-day uses of mica required large sheets, and smaller pieces were left in the mines or thrown on dumps. Nowadays, however, all sizes are utilized, although the bigger ones command much higher prices. The small pieces have many applications as such, but thin sections of them can also be built up into large sheets known as micanite or mica-board. A means of assembling small sections was discovered in 1892 and had far-reaching effects. Built-up mica is made by pasting together tissue-thin splittings—only about 1/1,000 inch thick. These are laid on paper or on a fine-mesh screen, succeeding layers being sprayed or brushed with



ELMYRA GIBBS NO. 1 MINE

This property is owned by Ernest L. Briggs and operated by the Capital Minerals Corporation. The mine was opened in 1915. Specimens of block mica obtained from it are shown. The compressor house is typical of the mica region, having doors in the rear wall that can be opened to provide through ventilation. The machine is an Ingersoll-Rand 210-cfm. unit. The men are John Carroll, foreman, and J. A. Mayberry, manager.



ELECTRICAL USES OF MICA

In a recent article on critical electrical materials, John Horn of the General Electric Company wrote: "Mica, the only useful material for certain insulation uses in electrical construction, is still an unmatched material for applications where its outstanding characteristics are actually needed. Mica is being conserved through improved production and application methods and also by reducing the thicknesses to the amounts actually needed, where formerly greater thicknesses may have been used as an additional safeguard. In one particular application, a change from 1/32 to 1/50 inch produced a saving of 3,800 pounds a year." The pictures show: upper right, a dismantled commutator with mica cones and collars; upper left, a large mica-insulated alternating-current coil being taped; and, immediately above, an antenna tuning inductor for radio transmitting equipment with injection-molded mycalex supports at the left.

a suitable binder until the desired thickness (up to 5/8 inch) is reached. The resultant plate, usually 3 feet square, is oven-heated to 250°F. to dry the binder and is then inspected in a dark room over a strong light or sometimes under X-rays. Imperfections are removed and more material is added, and thin places are built up. The sheet is next compacted under 1,000 pounds pressure and at a temperature of 300° for several minutes and chilled quickly. The surfaces are now milled or sanded and ground perfectly smooth to the exact thickness. In some plants the mica flakes fall from a "snowing" tower onto a suction drum or a moving screen on which from one to three layers are thus deposited before the binder is sprayed on.

Approximately half the built-up mica made in this country is manufactured by several of the large electrical companies which use the product in their own motors, generators, and appliances. Micanite can be formed into tubing and other shapes. The binder employed must have properties similar to those of mica. Shellac was formerly used exclusively, but has been largely replaced by glyptal, a glyceride resin patented in 1926 by General Electric Company research engineers. The development of built-up mica has considerably reduced costs wherever it is taking the place of large sheets. For example, the frames in a better-class toaster are now made of three pieces of mica at one-third the outlay for a single sheet. Additional labor is needed, but this is more than offset by the lower cost per pound of the smaller pieces. The United States production of built-up mica in 1940 amounted to 4,413,000 pounds valued at $5,811,000. This was 250 per cent greater than the 1938 output and represents an all-time high. This remarkable growth has continued, although at a naturally lower percentage rate.

The splittings required for built-up mica have come mostly from India in recent years, except during brief periods when the supply was shut off or when a rise in the market price prompted local producers to attempt to compete with the imported material. Indian labor is not only much cheaper than ours but also has had years of training. Of late, American men and women have rapidly developed skill in this exacting work approaching the best in India. There, the small blocks or "books" of mica are split by hand by women or children, working mostly in their homes for a wage of nine to twelve cents a day. Much amber mica was formerly split in Canada, but since the discovery of that variety in Madagascar, where low-cost labor is available, Canadian operations have decreased. A good deal of the block muscovite mined in South America during the past few years was sent to India to be split and then reexported. Sheet mica from India also has been preferred because of the excellent grading done there, imperfections often being eliminated by resplitting a sheet, a job at which experienced Indian graders are very adept. Purchasers in this country have, consequently, been willing to pay higher prices for Indian sheet mica because they could depend upon it being exactly as specified. However, domestic sheeters and trimmers are now furnishing very good grades, and the handicaps under which American producers have been laboring will probably soon be eliminated.

In these circumstances, the United States has been entirely dependent upon India for splittings of all kinds and also for sheet mica for radio condensers and certain other special uses that demand carefully graded material. In the Bureau of Mines *Minerals Yearbook*, review of 1940, it was stated that "An attempt to

INSIDE A MICA HOUSE

Seated at a bench and facing a north wall having continuous windows, these men split blocks of mica into thin sheets, using only a strong, stiff knife. Each sheet is inspected carefully against the light and then trimmed to obtain the largest possible rectangle free from iron stains and structural defects. For many years India has excelled in this processing of mica; but through force of necessity American workmen are relearning the lost art of their grandfathers and becoming adept at both splitting and grading.

cover any larger proportion of our needs of such mica from domestic or other foreign mines would seem impossible." Yet, in the face of that discouraging prediction, our mica-producing areas are making good headway and are supplying a good share of our requirements. The Government is, of course, coöperating closely, and only last month a new price schedule was introduced calling for increases of from 15 to 140 per cent in the existing market figures for various grades. Although prices already were at the best levels reached since the last war, an investigation revealed that few operators were making a fair profit, and the latest advance was calculated to serve as an inducement to greater effort and, hence, insure increased output. The new scale prevailing in North Carolina ranges from $2.40 a pound for 1½x2-inch sheets up to $9.12 a pound for 6x8-inch sheets. The price for the 1½x2-inch size is more than five times that posted last March. The present quotation for punch mica is 30 cents a pound, which is a rise of eight cents over the previous one. A Government subsidy plan permits the user to obtain mica at well below the high prices paid the miners.

Uncle Sam is also helping domestic mica miners in other ways. The Metals Reserve Company has set up the Colonial Mica Corporation as its agent and staffed it with men experienced in the mica industry. This concern buys mica for the Metals Reserve Company, which resells it to mica users upon allocation by the War Production Board. A second important service rendered by the organization is that of renting air compressors, rock drills, hoists, pumps, and other equipment to the mica miners. The rate per month for most of this machinery is 2 per cent of its cost, but there is a higher charge for rock drills, pumps, drill steel, and air hose because of their comparatively shorter life. Before providing equipment, Colonial sends a fieldman to examine the applicant's property. Samples of the deposit are taken and estimates made of the amounts of the required grades of mica that are available. The organization also determines what type and size of machinery will be needed; instructs miners how to prepare their mica for marketing; and maintains exhibits of correctly trimmed and sheeted mica at different places in the district.

These various aids are essential to volume production, for the business of mining mica is one of the most uncertain pursuits in the whole category of the minerals industries. Since all commercial grades of muscovite are found in association with pegmatite dikes, it might be assumed that the problem is merely one of locating a pegmatite dike and going to work. However, it is not so simple as it sounds. All pegmatite dikes do not contain mica, and when they do there is no certainty as to how much will be there or just where it will be discovered. After it is found, the crystals may not be large enough to yield good-sized sheets, and if they are of satisfactory size they may be so imperfect or distorted that they will not provide pieces 1x1-inch or larger free from cracks, waviness, or other structural defects. Or the sheets may be marred by stains that greatly reduce their value and their suitability for certain applications. In short, it is impossible to determine in advance of mining either the quantity or the quality of a deposit, and this makes the venture a decided gamble.

Diamond drilling does not help, because the mica segregations are small and scattered and hence easy to miss. Surface outcroppings may be quickly exhausted, and the search for additional deposits entails prospecting along narrow, crooked workings. In consequence of this capriciousness, it doesn't pay to invest a lot of money in plant and equipment until a deposit of high-grade mica of persistent occurrence is proven. This accounts for the fact that most mica mines are conducted as small-scale "gophering" operations that must pay for themselves as they go. It also explains why many of them are worked by hand methods, at least until they have proved to be worthy of mechanization, and why portable compressors and simple, easily moved headworks, hoists, and other items of equipment are chosen when mechanization is adopted. Knowing all these things, the Government's experts realized that it would be necessary to reduce the risk by offering machinery on easy terms and by guaranteeing prices that promise a fair monetary reward for the time and effort expended.

However, not all mica mining is transitory and on a small scale. On the contrary,

SMALL MINE HEADFRAME

This is typical of the structures erected over small mines that are worked through shafts. Because mica is something of a vagrant mineral whose whereabouts can be learned only by digging for it, mica miners are reluctant to spend much money for equipment until they know through intensive underground exploration that it is warranted. Crude apparatus and simple tools prevail, and only since the Government initiated its drive for strategic mica have mechanical aids been widely adopted.

there are in some parts of the country, such as North Carolina's tri-county area of Mitchell, Avery, and Yancey, a number of well-rooted establishments that have weathered many years of varying fortunes in the business. There is, for example, the Tar Heel Mica Company, Inc., which David T. Vance founded more than 40 years ago and still runs. In 1891, he and his brother, T. B. Vance, built the first mica-grinding mill in the state and the second one in the United States. The company now produces cut and uncut mica, stampings of different forms and dimensions, tubes, segments, V rings, and other shapes in sheets and built-up board, and also radio-condenser films. In addition, Mr. Vance operates two grinding plants individually.

Then, too, there are the Heap and Clapp properties now owned by Mrs. Ella Clapp Thompson who was born at a mica mine and grew up to become nationally known through the woman's suffrage movement and as a Government official. These holdings are in Mitchell and Yancey counties and are sources of mica, feldspar, and other minerals. Mrs. Thompson's father, Elisha Clapp, is credited with having started the mica industry in North Carolina. While riding through the Blue Ridge Mountains on horseback at the close of the Civil War, he stopped overnight at the home of Dave Patton in Johnson City, Tenn. There he saw a large sheet of mica on a mantel in the living room. Knowing something of its commercial value, he learned that it came from Mitchell County, and went there. He negotiated with the owner of the land, and then sent for John G. Heap, his partner in a hardware business at Huntsville, Ala. Together they acquired various properties and began preparing for the market their own product as well as that of others who had followed their lead in mining the mineral. The greater share of it was cut to sizes suitable for stove windows, and before long Heap and Clapp controlled

TYPICAL WORKING FACE

Underground in the Deer Park, showing an unusually wide pegmatite dike. It is one of the deepest shaft mines in the tri-county area.

that business in the United States and Canada. Between 1868 and 1882 most of the mica produced in North Carolina came from their mines, which at times numbered as many as 30. During that period the price of sheet mica ranged from $3 to $11 a pound. Heap eventually sold his interests, and Clapp's passed to Mrs. Thompson upon his death.

There is also the Meadow Mine, which claims to have operated more steadily in good times and bad than any other in the district. Reputedly discovered by a former slave when blasting out a tree stump, this property has been in the Avery family for three generations and is now owned by Mrs. Waites Avery, Sr. It has been developed through three adits, each extending about 900 feet into the mountainside. They are said to be the deepest mica workings in the country. The mineral-bearing pegmatite dike is nearly horizontal, in contrast to the steeply pitching ones generally found. When in blocks, the mica appears jet black, but when split into sheets it is clear.

A pioneer in the industry, and for many years acclaimed as the "mica king" of the state, was the late J. E. Burleson, familiarly known as "Uncle Jase." At times he operated from ten to fifteen mines, which were successful largely because he developed facilities for preparing pattern mica which could compete with the product from India. In 1920, Burleson sold his processing plants to the Asheville Mica Company and retired. Most of the mines have until lately been inactive because of the capital it would have taken to unwater and otherwise prepare them for working A New York group recently purchased these properties and is getting ready to reopen and operate them extensively. Another old producer is the Deer Park Mine No. 5 which has been active for more than 60 years. It is one of the deepest shaft mines in the area, reaching down 435 feet.

Among the newer large-scale operators is the Meyer & Brown Corporation of New York. This firm had to give up its established business of importing rubber when the Japanese overran the Malay Peninsula and the Netherlands East Indies and turned to mica mining. It has reopened several old properties and also runs two mica-sheeting shops. This concern is understood to be producing an average of about 10,000 pounds of mica weekly. Another comparative newcomer in the field is Ernest L. Briggs whose holdings aggregate 1,100 acres and who is operating several mines.

COMPRESSORS FOR RENT

Some of the scores of portable air compressors that have been purchased by the Colonial Mica Corporation, a Federal agency, for rental to mica miners. It also leases drills, pumps, hoists, and other equipment on liberal terms.

Although a few of the mines have their own mills for grinding scrap, there are concerns that specialize in this work, obtaining their material from independent miners. The English Mica Company has four grinding mills and provides mica suitable for use as a filler in paint by its own method of exceedingly fine grinding. The Harris Clay Company, which is in the business of producing china clay, recovers fine mica from kaolin by flotation, having developed the process in 1935 in collaboration with the Norris Ceramics Laboratory of the Tennessee Valley Authority. The firm is reputed to be the world's largest producer of unground fine mica.

It is estimated that more than 2,500 persons are now engaged in mining and processing mica in North Carolina, mostly in the Spruce Pine District, and the number is increasing steadily. As can be inferred from what has been written, most of the mines are small undertakings, employing only a few persons. Despite the liberal terms on which the Government is offering to rent tools and machinery, some 150 are still being worked with hand drills, picks, wheelbarrows, and other simple equipment. Most of these will either be mechanized shortly or abandoned for more promising prospects.

The pegmatite dikes are usually narrow and inclosed in wall rocks of gneiss or schist. The mica is in lenses or columns and generally adjacent to one of the walls. Access to the deposits is gained either through shafts or adits, depending upon the topography. In some locations the wall rocks are weathered to a depth of 30 or 40 feet and timbering is required, but in others the workings are entirely in hard rock. A typical dike or "vein" is from 3 to 6 feet wide, runs in a northeast and southwest direction, and dips at an angle of from 15 to 80° in a southerly direction.

Where power drills are available they are nearly always Jackhamers, which are mounted on columns to drive drifts. An experienced miner usually knows in what part of the dike the mica concentrations are most likely to be found and places the blast holes so as to cause a minimum breakage of the crystals. When mining a very narrow dike, all holes are drilled in the wall rock as an added precaution against shattering the mica. The broken material is generally hoisted to the surface or to the haulage level in cylindrical buckets or cans, which are equipped with hinged yokes to facilitate dumping and are ordinarily handled by 15-hp. gasoline-engine-driven hoists. In comparatively flat dikes, cars running on light rails are sometimes used. Drilling is mostly done with conventional forged steel, although Jackbits are now being tried out.

Necessity being the mother of invention, many domestic mica workers have been relearning how to prepare sheet mica for the market—an almost lost art in this country—since imports from India decreased. The trick is to get the largest possible rectangular area of clear, stain-free mica from each sheet. There are no fixed rules for the worker to follow, and his skill and judgment count heavily. The sheeters, as they are known, work in a rough shed—called a mica house—adjacent to the mine. They sit at a bench arranged along the north wall of the building, which has continuous windows to provide ample glarefree light.

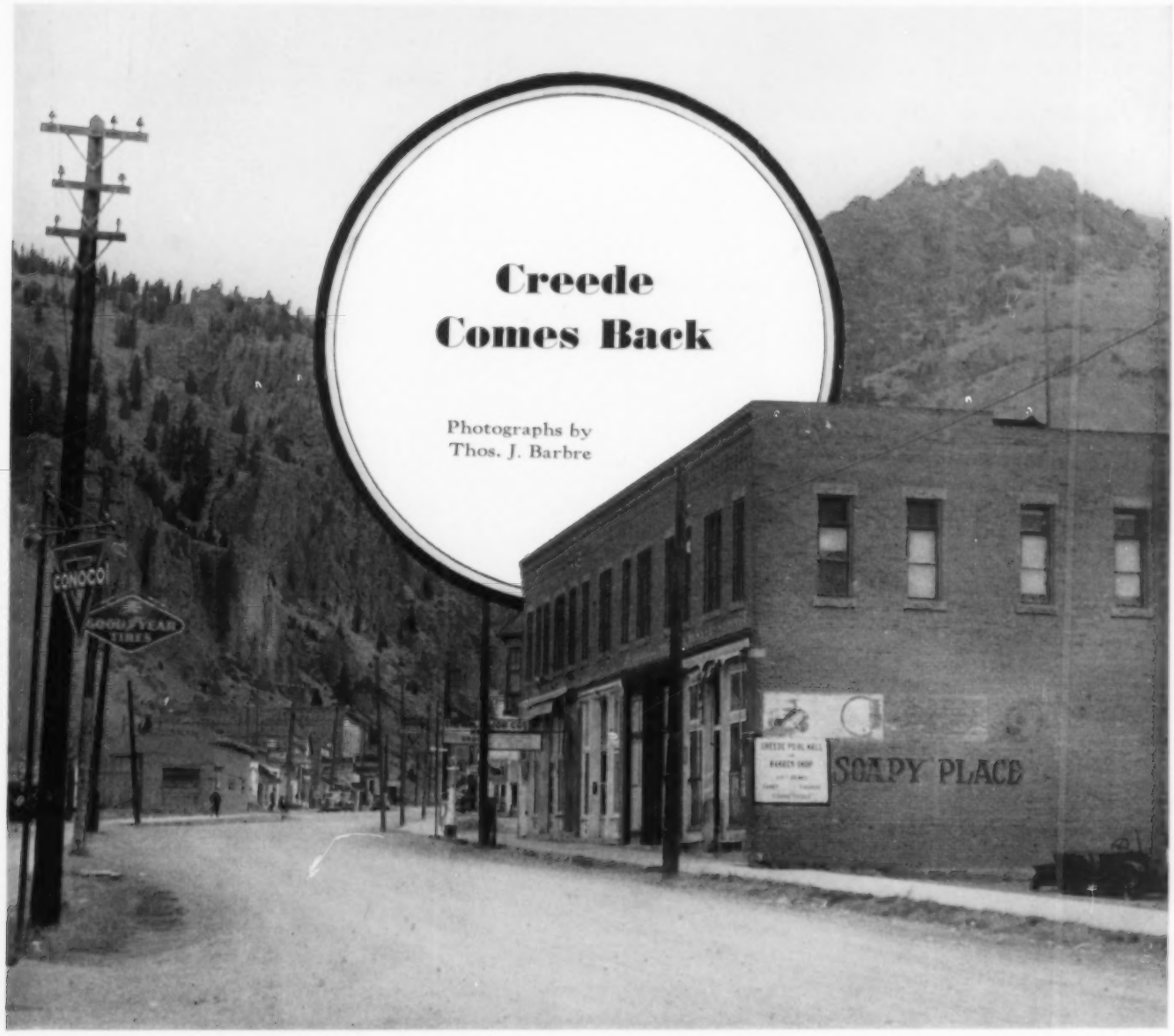
The sheeter's only tool is a strong, stiff knife. With this he splits thin sheets from a block of mica, examines each one carefully by holding it against the light, and then trims it so as to include a maximum of high-grade material. The block mica is piled toward the back of the bench. Each worker throws the waste material back of him onto the floor and puts his trimmed sheets into a cardboard box in front of him. When a considerable supply of finished sheets has accumulated, they are inspected, graded, and classified for size, each size being packed in a wooden barrel for shipment. Only first-class sheets command the prices previously given. Inferior ones bring proportionately less as impurities and defects increase. Six distinct grades are recognized under standards set by the American Society for Testing Materials.

CLOUDLAND MINE AND ITS OWNER

Below is a view in the Cloudland Mine, which is owned by Mrs. Ella Clapp Thompson and operated by the Rev. Julius Henline, of Hawk, N. C., who is shown second from the left. The picture was taken about 150 feet in from the portal of the access adit while the mine was being cleaned out preparatory to resuming activities that were suspended several years ago. Mrs. Thompson inherited extensive mica properties from her father, Elisha Bogue Clapp, a pioneer operator. Born at a mica mine, and educated largely in private schools, she went to Washington when she was eighteen and entered the Government service, obtaining a position by finishing a Civil Service examination ahead of twelve men. While in Washington she studied geology and mineralogy in night classes at the Corcoran Scientific Institute. In 1905 she married E. St. Clair Thompson, a Texas lawyer. Mrs. Thompson received a law degree from Fordham University in New York in 1928, and during the two following years was a special assistant United States Attorney for the southern district. Following her husband's death in 1933 she lived in New York for four years and then moved to Bakersville, N. C., where she now resides.

Creede Comes Back

Photographs by
Thos. J. Barbre



FIFTY years ago, Creede, Colorado, was a bustling silver-mining camp, with never a doubt that its prosperity would endure indefinitely. But when silver was demonetized and its price fell, Creede lost its place in the sun, and most of the population moved away. After a long hiatus, Creede is again producing mineral, but it is the strategic metals lead and zinc that have given it a new lease on life, with silver relegated to the status of a by-product.

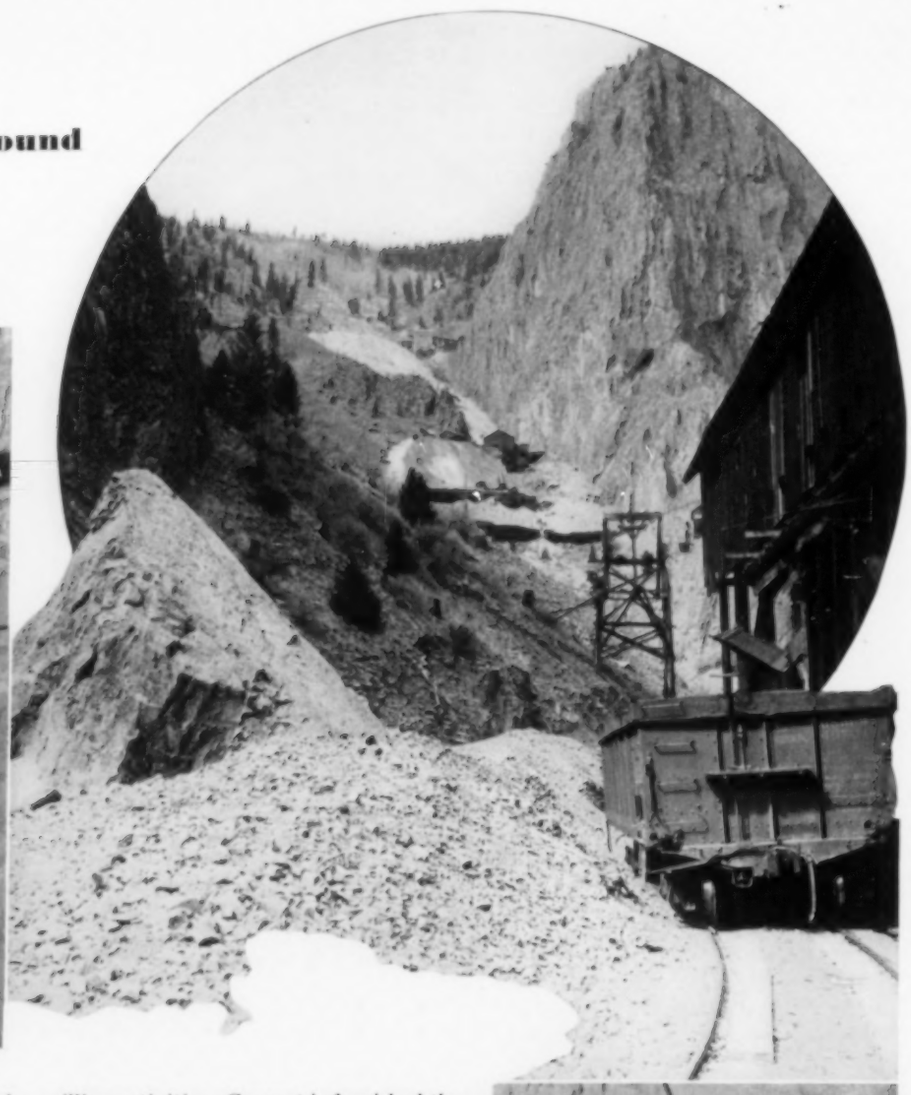
Creede was named for its discoverer, N.C. Creede, a prospector who stuck his pick into many of Colorado's hillsides before he made his strike. In 1890 he made his way up the valley above Wagon Wheel Gap, which was then the terminus of the railroad. Float rock led him to an outcrop of silver-lead ore that assayed $80 to the ton. Creede christened his claim the Holy Moses, for these were the first words that came from his lips after he made his find. He sought funds for developing it from D.H. Moffat, a Denver banker who was later to give his name and his fortune to a short-line railroad from Denver to Salt Lake City. This road, which includes the Moffat Tunnel, is now a part of the Denver & Rio Grande system.

Moffat and two associates took a bond and lease on Creede's prospect for $65,000 and started mining it, meanwhile employing Creede to continue prospecting on a share basis. By 1891 there were so many people in the camp that Moffat asked the directors of the Rio Grande Railroad, of which he was president, to extend its tracks from Wagon Wheel Gap. Most of the directors lived in the East and there were delays in taking action on the request. So, when the decision was not made right away, he put up $70,000 to do the work and got it back later.

In Creede there was a meat market run by Ralph Granger and Erl von Buddenbock, and to them came Theodore Renninger, a prospector seeking a grubstake. They backed him, and, with Julius Haas as a partner, he uncovered rich ore on Bachelor Mountain. Creede happened along right after the strike and asked the pair to define the limits of their claim, which they called the Last Chance. He then staked adjoining ground, and it became the Amethyst Mine.

Creede was a roistering camp from the start and had its full share of lawlessness. Shown here is its main street, where dozens of saloons once flourished. By contrast, it is impossible to buy an unbottled drink in the town today. On the right is a sign designating "Soapy" Smith's place, which was publicized in verse and story. "Soapy" is reputed to have done very well selling unsuspecting persons a cake of soap wrapped in a dollar bill. The only difficulty with the transaction was that the bill always mysteriously disappeared during delivery to the customer. In this same block Bob Ford had his saloon and was killed there. Present-day Creede residents are serious-minded folk with neither the time nor the bent for carousing.

Wealth from the Ground



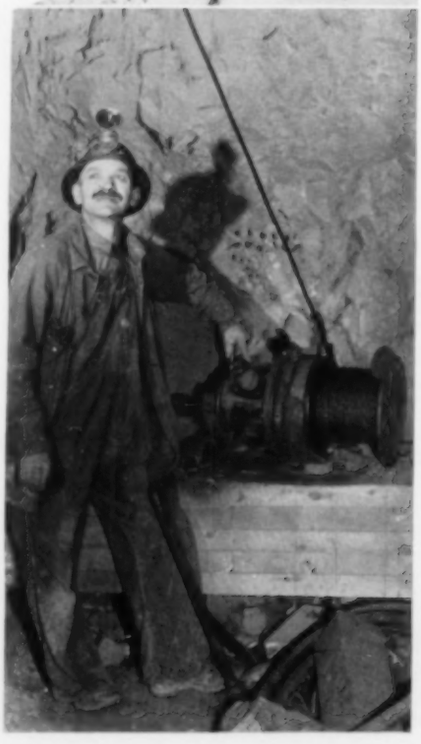
THE leading industry in Mineral County, and the only one of any importance, is metal mining, and the operations are concentrated in the Sunnyside Mining District, with Creede as its center. All mining of consequence is conducted by the Emperius Mining Company, which has acquired ownership of all the worth-while old-time properties. These include the Amethyst, Last Chance, New York, Pittsburgh, Texas Boy, Commodore-Bachelor, Del Monte, Happy Thought, Little Bear, and Kanawha mines. Together, they cover a mineralized zone 2 miles long and ½ mile wide. They are mined essentially as one property. Twelve levels have been opened up there, and the workings of all the mines have at times been interconnected to obtain good natural ventilation.

B.T. Poxson is president of Emperius, and George H. Garrey is consulting geologist. The mining and milling operations give employment to an average of 160 men who work under the direction of E.W. Nelson, assistant general manager, and W.L. Anderson, mill superintendent.

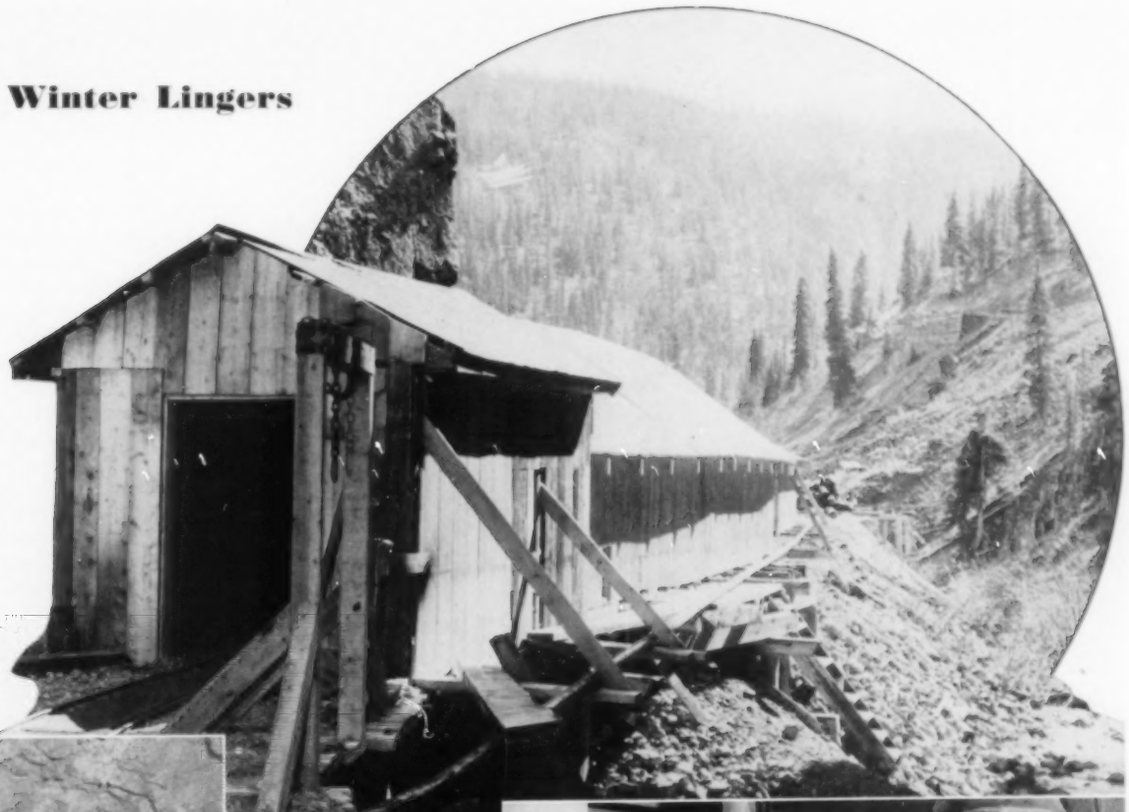
The company operates generating plants to supply power for all mining and milling activities. Current is furnished the mines from two main stations: one on the Commodore property at the south end of the district, and the other at the portal of the Amethyst adit at the north end. Both of these plants were put in last year.

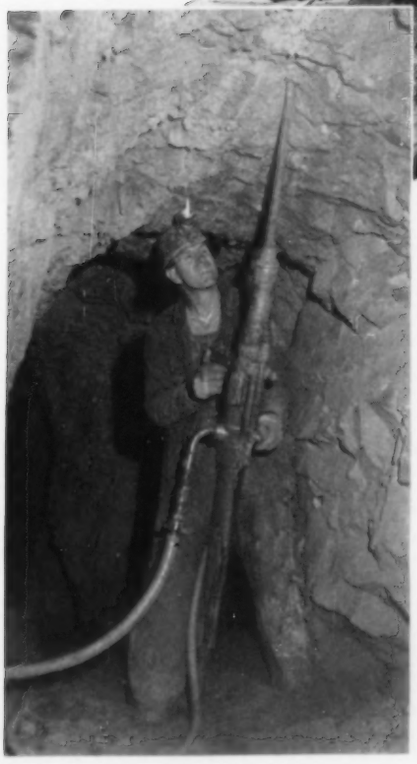
The exterior view on this page shows the Commodore Mine perched high on the side of the canyon wall. The canyon has been formed through past geologic eras by the headwaters of the Rio Grande River, which is a brawling stream at this point and attracts trout fishermen from near and far. In the picture is seen one of the gondola cars in which high-grade ore and concentrates are transported over the Rio Grande Railroad to the outside world. This is one of the few standard-gauge rail lines remaining in the mountainous sections of Colorado. Once a week a train steams into Creede to bring supplies and to take out the loaded ore cars.

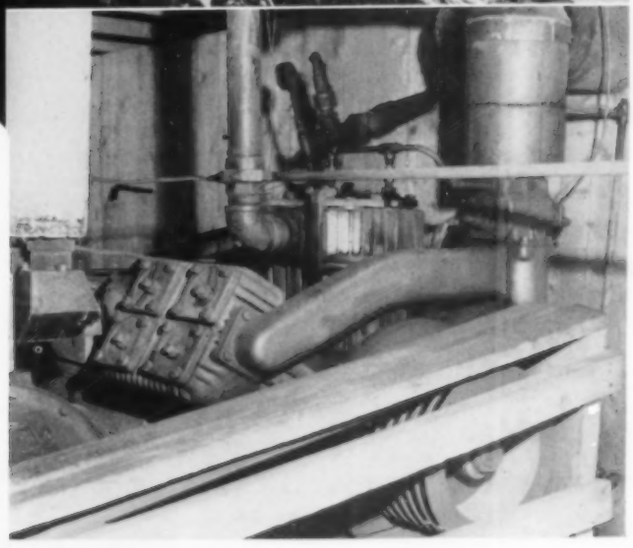
Hoisting of the ore in winzes and raises is done by buckets handled by Ingersoll-Rand air hoists, six of which are in continual use. The one shown, with Eric Nelson, mine superintendent, at the throttle, moves 35 tons of broken material up a 230-foot shaft in two 8-hour shifts.



Where Winter Lingers







THE winters are long and severe at the 9,000-foot altitude, and the snow lies deep at times. To facilitate handling the ore that comes from the Amethyst adit and to protect the workmen during inclement weather, a snowshed has been erected outside the portal.

All the current production is coming from the hanging-wall area of the Amethyst vein system. Crosscuts driven into this wall have located numerous parallel veins ranging from 20 to 50 feet apart. Some of the crosscuts have penetrated 600 to 700 feet and are still intercepting profitable ore bodies. Ore of high zinc content was encountered on the three lower levels and was being held in reserve until the higher-grade silver ores had been mined. However, as a result of the war demand for zinc, its production was decided upon and changes were made in the milling process to handle the ore.

Compressed air is furnished to the underground workings by three Ingersoll-Rand Type 40 air-cooled machines, each housed in a small building on the surface and exposed to the southern sun. In the summertime the air inside these structures gets warm, so the intake and exhaust lines of the compressors have been inclosed in larger pipes that extend outside and provide a flow of cooling air within. Although the compressors and their engine drivers operate an average of seventeen hours a day, the former never reach a temperature of more than 160°F.

Stoping in the Emperius properties is done with Ingersoll-Rand R-58 Stopehamers of which there are ten in service. The average drilling round consists of twenty holes each 4 feet deep. Some of the more experienced miners put in 45 holes in an 8-hour shift with one of these machines. Development work is done with nine DA-30 drifters and one DA-35.

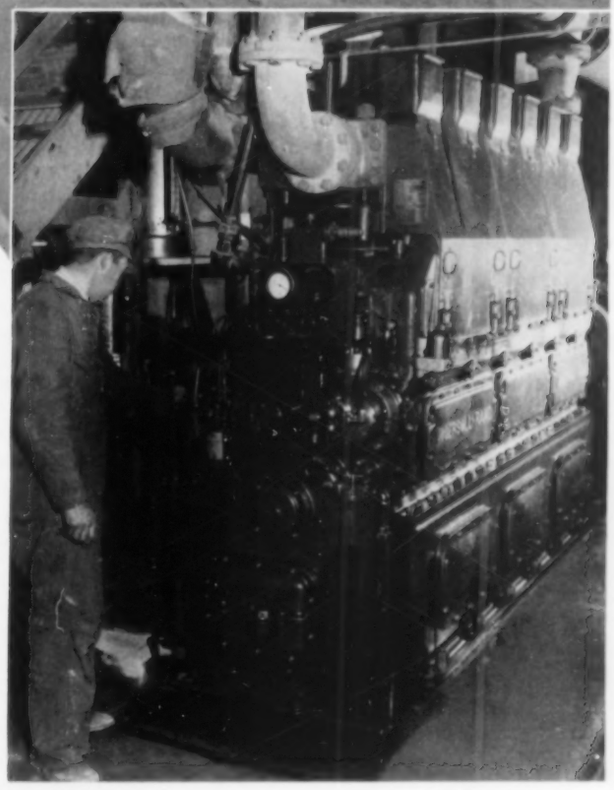
a very pronounced structure that runs through all the section that is now being mined.

One of the structures shown in the foreground of the exterior picture houses the blacksmith shop, with its complete equipment for reconditioning drill steel. Jackbits have been used for all drilling for the past two years. The prevailing rock is rhyolite, with some quartz and porphyry, and is classed as medium-hard. It stands well in openings, and no timbering is required. Bits of 2-inch gauge are utilized to start the holes and are reduced ⅛ inch at each resharpening, being used until they measure 1½ inches. This reconditioning is done with an Ingersoll-Rand J2 Jackbit grinder that is located in a small room at the mill. One of the busiest machines in the blacksmith shop is a No. 500 cutoff wheel, which is shown here in action. It performs the dual service of cutting off drill rods and of squaring shank ends to prevent undue wear on drill pistons.

The Amethyst Mine

HIGH on the mountainside above the Amethyst Mine buildings that are now in use are the old surface buildings and huge dumps of waste rock that attest to the extensive operations of bygone years. Although hundreds of mines were started in the area, it is said that only the Amethyst, the Last Chance, and the New York were ever consistent dividend payers. Probably no single property could be made to yield profits today, but by combining all of them in one enterprise Emperius is reaping the benefits that come with the economies of large-scale operations.

During the early mining, shafts were sunk to follow the ore downward. Later, an adit was driven into the hillside of the Amethyst to intersect the vein, thereby furnishing drainage and eliminating the cost of hoisting. Virtually all the mineralization is along the Amethyst vein system,



The Emperius Mill

THE high-grade ores that are produced in the Creede district are shipped to the Leadville smelter of the American Smelting & Refining Company. All other ores are treated in the modern 150-ton flotation mill of the Emperius Mining Company, and the concentrates are then sent to the smelter. The 1941 mine production was 41,600 tons, from which were recovered 750 ounces of gold, more than 1,000,000 ounces of silver, 2,191,000 pounds of lead, and in excess of 1,000,000 pounds of zinc.

The mill is situated a short distance from Creede, and the ore is transported to it in six 5-ton trucks which average a round trip over a haul of approximately 2 miles every 45 minutes. Stretches of the road are on a grade of 26 per cent. Outside ore-storage facilities at both the mine and the mill have a combined capacity for one month's mill run. The mill provides a conventional flotation circuit for the recovery of the lead and zinc. The gold and silver are caught on a riffle table. Results are checked regularly in a modern chemical and metallurgical laboratory.

Power for the mill is furnished by an Ingersoll-Rand Type S 6-cylinder oil engine rated at 232 hp. at an altitude of 9,000 feet. It is direct connected to an Electric Machinery Company 175-kw. generator that produces current at 480 volts. This oil-engine generator was placed in service September 6, 1937, and has been running almost continuously ever since. It has never been shut down because of failure. The fuel consumption averages 84 gallons per 8-hour shift.

In one of the pictures, Mill Superintendent W. L. Anderson is shown beside an Aikins classifier.

This and That

Oil Lamps Persist

Most persons along the eastern seaboard are worrying about gasoline for their automobiles or heating oil for their furnaces, but the American Petroleum Institute points out that more than 2,000,000 homes in that area are wondering if they will get kerosene for their lamps. Surprisingly, one in every fourteen in seventeen east-coast states and the District of Columbia is without electric lights. Most of them are in the rural districts, but some are in the cities, even in New York. Three-fourths of the petroleum-lighted dwellings are in the six South Altantic States of Virginia, West Virginia, North Carolina, South Carolina, Georgia, and Florida. Georgia alone numbers 405,165.

* * *

Metals from Ashes

Last year, 624,000 pounds of metal, worth $10,000, was recovered from ashes taken from two process-steam boiler pits in one of the General Electric Company factories. Its presence there was due to the fact that refuse and rubbish from all parts of the plant are used for fuel. The ashes are ground and then passed through a magnetic separator for removal of the ferrous metals. The remainder is passed over a concentrating table which sorts the various metals according to their specific gravity. Included in the yield are iron, steel, brass, copper, and aluminum. The same plant is now salvaging bits of copper that become separated from wire during the drawing operation. These particles are mixed with a drawing compound that serves to lubricate the dies. After use, it passes into a pit underneath the drawing machines, whence it is recovered for the extraction of the copper. Last year's production amounted to 88,200 pounds of metal worth $8,000.

* * *

Garand Given Award

John C. Garand, who sacrificed millions in royalties by declining to turn his semiautomatic rifle over to a foreign power, was the recipient of a special award on October 15 from the American Society for Metals. The Garand rifle, which can be fired at the rate of 40 shots a minute, is standard equipment for our Army and Marine Corps. Garand, who is a civilian employee of the Government, spent many years in developing his weapon. During World War 1, while engaged as a machinist in a textile mill, he designed a machine gun and sent drawings of it to Washington. He was summoned to the capital and asked to produce a working model. The war ended before he could complete it, so Garand was shifted to the armory at Springfield, Mass., and assigned to work on a semiautomatic rifle. His objective was a gun that would be simple, strong, and light. He designed and made six experimental rifles and then combined the best features of all of them in one weapon. Next followed a long period of building, testing, and rejecting. He tried dozens of kinds of gunmetal, and redesigned the rear sight alone 50 times. In the end he produced his present model, which weighs 9¼ pounds and uses .30 caliber cartridges in clips of eight. The gun is composed of 72 pieces and utilizes the pressure of the discharge to eject the spent shell and to inject a new one into position for firing. Garand assigned exclusive rights to the gun to the United States Government. Military experts have declared the weapon to be the "best high-speed firearm on earth."

* * *

Mine in Two States

The Jack Waite Mine straddles the Idaho-Montana boundary line. The vein outcropped in Idaho, and the initial work was done there; but as the ore bodies were followed downward they pitched over the line into Montana and all production now comes from that state. The ore is trammed underground into Idaho and hoisted there. It is then hauled to the Northern Pacific Railroad and shipped back to Montana for treatment at East Helena.

* * *

Iron Plus Gold

The Homestake Mine of Lead, S.Dak., the nation's leading gold producer, is proving to be a prolific source of scrap metal. Having been operated since 1879, the property has accumulated sizeable supplies of iron, steel, and other metals in the form of obsolete buildings and equipment, and a concerted salvage campaign has been conducted to retrieve the materials for the war effort. During the ten months ending on August 16, the mine shipped 6,228,788 pounds of miscellaneous steel scrap, 237,700 pounds of manganese-steel scrap, and 46,370 pounds of copper and brass scrap. The site of old shop and foundry buildings, long since covered with debris, is now being "mined" for base metals, and so far a power shovel has unearthed as much as 400 tons of them.

"Don't look now, but the boss was leaning against the truck when you dumped that load."

* * *

Tea for Troops

In order that Indian troops serving overseas may have their accustomed tea, the Indian Tea Market Expansion Board has supplied ten specially built cars designed to dispense the beverage in the field. Each car is divided into two compartments, each of which has counters on both sides so that tea can be served simultaneously to both Mohammedans and Hindus. Each compartment has facilities for making tea and for washing the cups. A car can prepare and dispense 600 cups at a time and carries a reserve supply of water for an additional brew of the same quantity. Insulated urns keep the beverage hot until it is served. The vehicle also carries a radio receiving set with an amplifier and two loudspeakers, a phonograph, and a microphone connected with the loudspeaker system for use in making announcements to the assembled soldiers. It is claimed that the Indian troops relish a well-brewed cup of tea more than anything else that could be provided for them.

* * *

Riches from a Road

Last March roadbuilders, constructing a highway along the American River above the Ruck-a-Chucky dam site in California, cut away a hillside and exposed several narrow seams of quartz. Following a rainstorm, the bank sloughed, and one of the workmen found free gold in the formation. Roadbuilding was promptly forgotten in favor of mining. In one day five men recovered $2,232 worth of the precious metal, and in two months the deposit yielded $30,000 to the former laborers and others who were attracted by the news of the find. They formed a partnership and agreed to divide the proceeds. However, it developed that the land had been reserved for power development and was not open to mining operations. The $30,000 was impounded until ownership could be established. The Government sought to recover it, but Congress passed a bill awarding it to those that had mined it.

Underground Air Receiver in Coal Seam

*Thomas Murphy**

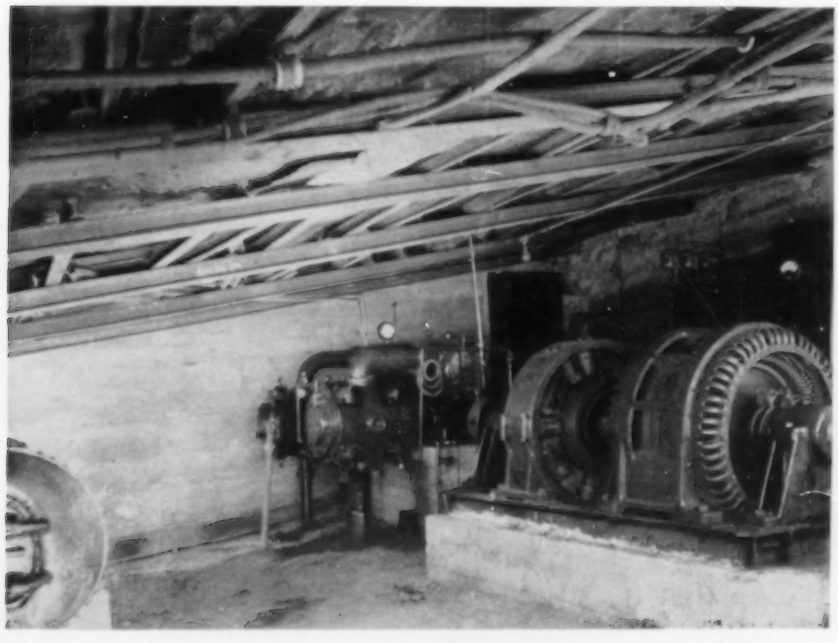
SURFACE BUILDINGS

Tipple of the No. 3 Mine shown against a background of high hills forming one of the numerous spurs running eastward from the Cascade Mountains. The location, near Roslyn, Wash., is in a land of fir and pine trees.

AN ARTICLE in the July, 1941, issue of Compressed Air Magazine describes how a blind drift in a metal mine is utilized as an underground air receiver, the plan having been worked out by Charles Pengilly, manager of the Tebekwe Mine of the Homestake Gold Mining Company at Selukwe, Southern Rhodesia. The purpose was to avoid the necessity of installing larger compressors to take care of an expected increase in drilling operations.

That article inspired the construction this year of a similar receiver in the No. 3 Mine of the Northwestern Improvement Company at Roslyn, Wash. The company is owned by the Northern Pacific Railroad and the mine furnishes coal for use on that line. The chamber has a capacity of 25,000 cubic feet and was excavated in the coal seam itself. It has now been in service about five months and has proved satisfactory in every way. There are few if any receivers of this type in this country.

*Superintendent, Northwestern Improvement Company

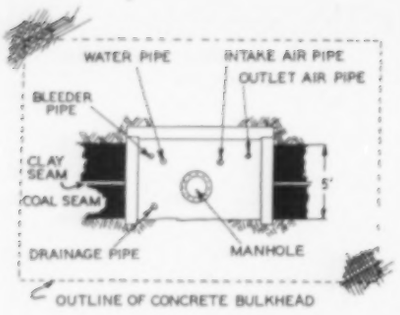


UNDERGROUND SUBSTATION

In the foreground at the right is a 2,200-250 volt, 200-kw. motor-generator set. Beyond it is the Ingersoll-Rand 290-cfm. compressor that now furnishes all the air required for the operation of the twenty auger drills and five Jackhamers used in the mine. Prior to the construction of the underground chamber-receiver, this machine and another one of 115-cfm. capacity could not keep up the air pressure when a considerable number of the drills were running simultaneously.

When the work was undertaken, air was being supplied by two compressors—an Ingersoll-Rand Type XRB-2 of 290-cfm. capacity and a smaller single-stage unit of 115-cfm. capacity—set up in an underground station 1,200 feet above sea level. The larger machine was acquired in 1936 to provide power for drills used in driving some tunnels, and the smaller one was added later. After tunneling had been completed, air-operated coal drills were tried out and were so successful that they were generally adopted. Twenty Ingersoll-Rand Size CS auger drills are now utilized for drilling coal and five JA-35 Jackhamers for drilling top and bottom rock in entries. When all these machines were working together they required far more air than the two compressors could furnish. Only because drilling was intermittent were the compressors capable of maintaining even approximately effective pressure in the lines. On occasions the drills would "gang up" and the air pressure would drop below the effective level. At other times, when most or all the drills were idle, the compressors would quickly build up full pressure in the three 175-cubic-foot steel-tank receivers and in the 20,000-odd feet of 2-inch air-distribution lines. Then the compressors would idle until more drills were started.

The mine operates at full capacity on one 7-hour shift and at about 25 per cent of capacity on a second shift that is devoted to development work. It seemed obvious that, with adequate storage



FRONT OF BULKHEAD

capacity for compressed air, it would be possible to run the compressors at 100 per cent load factor throughout the full 24-hour day if necessary but that, inasmuch as they run unloaded part of the time even during the main day shift, there probably would be no need of operating them much beyond the duration of the working shifts. Actually, the building of the large receiver has permitted the mine to discontinue the use of the smaller compressor and to move it to another where it was badly needed. Besides, the remaining 290-cfm. compressor now runs at a better load factor.

The main slope of the mine intersects the Roslyn coal seam on the Pioneer level at elevation 1,387. Above the intersection is 700 feet of cover, consisting of about 50 feet of surficial glacial drift underlain by alternating layers of shale and sandstone, with a few interspersed small seams of coal. The sandstone strata are likely to be fissured, but it has been observed that the shale members are seldom broken except on the crests of the most abrupt anticlinal folds. Moreover, these shale beds are impervious to water infiltration, so it was reasoned that they would also effectually confine compressed air.

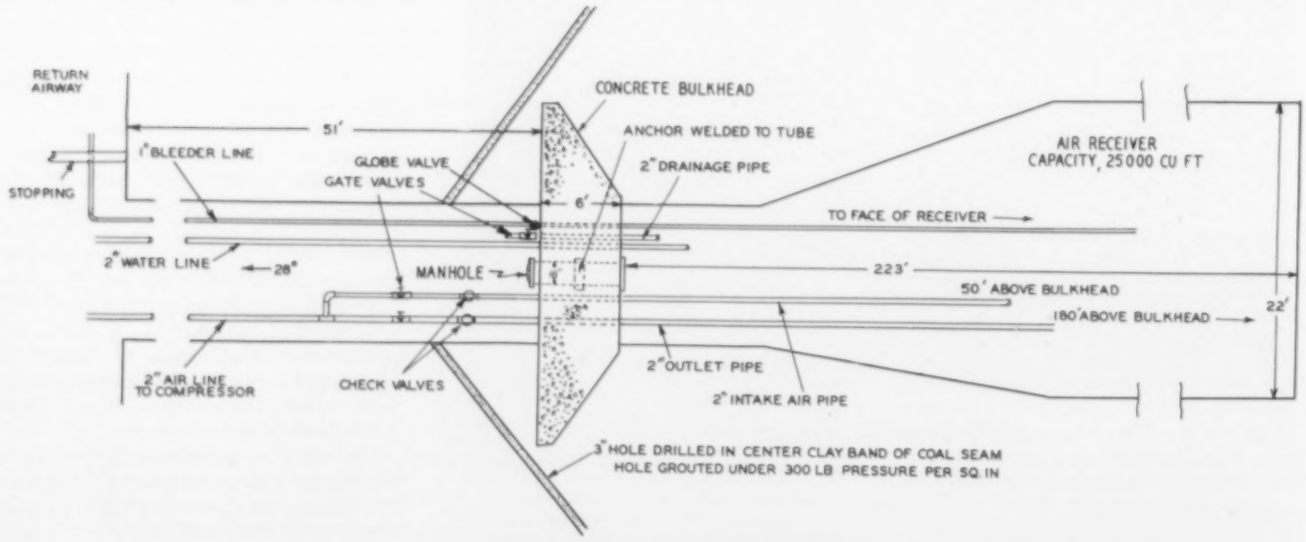
Immediately adjacent to the foot of the main slope on the Pioneer level there is a solid seam of coal that extends from the entry up to the crest of an anticline about 1,200 feet above. The layer of coal is approximately 5 feet thick and pitches about 28° from the horizontal. This block will not be mined until the remainder of the mine is worked out, so it was decided to drive the air-storage chamber up the slope in this seam. The immediate roof, which is common to the entire area, is a 5-foot stratum of shale, and below the layer of coal there is a 50-foot bed of sandy shale.

The first step in excavating the chamber was to drive a raise 10 feet wide in the coal seam for a distance of 61 feet. This was next carried 213 feet farther up the pitch and widened to about 22 feet. The wide section of the opening was then timbered with sets made up of 60-pound steel rails to prevent the roof from sloughing. A concrete bulkhead was constructed at a point 51 feet up the slope from the Pioneer airway and 10 feet from the top of the narrow raise. To key it into the surrounding rock, a channel 6 feet wide and 6 feet deep was cut in both the floor and the roof. After that, 7½-foot recesses were cut in the coal on each side and the floor and roof channels extended to the same limits. Cement, sand, and gravel were hauled up the raise to a location beyond the excavation for the bulkhead so as to take advantage of the pitch in running concrete into the forms. A concrete mixer also was taken to the same spot. This was a home-made unit having a bowl small enough to pass through the 18-inch-diameter manhole which was to be incorporated in the bulkhead.

As considerable methane is liberated from the coal seam at all working places, ventilation had to be provided while driving the raise and excavating the chamber. This was done by inserting a 12-inch sheet-steel pipe through a nearby stopping in the Pioneer airway where there is a vacuum of 1.8 inches, water gauge. By carrying the pipe up the chamber as it was being driven, the space was kept clear of gas. When the forms for pouring the concrete bulkhead were built, a section of 6-inch standard-weight steel pipe was run through the bulkhead section and connected above and below the latter to the sheet-metal pipe. In this manner the chamber was exhausted of gas while the concrete was being placed. After the bulkhead had been completed, the outside end of the 6-inch pipe was capped.

The shell of an old feed-water heater, 18 inches in diameter and 7 feet long, was embedded in the bulkhead to serve as a manhole. A 2-inch pipe for introducing compressed air into the receiver was extended through the bulkhead and about 50 feet up into the chamber, and a second 2-inch pipe to conduct compressed air to the working spaces was likewise run through and to within 43 feet of the top of the chamber. The terminals of these two pipes were located so as to create conditions favorable to the separation of moisture from the air before the latter is withdrawn from the reservoir. There were also embedded a 2-inch water pipe for testing purposes and another one for draining excess water from the receiver. Three 2-inch pipes were set in the forms for subsequent use in pumping grout up into the high areas of the roof channel.

As it was obvious that the chamber would fill up with methane gas after the bulkhead was built and ventilation was cut off, and as it was not desirable to let this gas reach the working places with the compressed air, a 1-inch pipe was carried through the bulkhead and to the highest point in the receiver. A continuation of the pipe below the bulkhead was run through a stopping into the return airway of the mine ventilating system and fitted with a gate valve. It is interesting to note that, when the chamber was being given its first charge of compressed air, nearly pure methane gas blew out of the end of this pipe for several hours. However, since the receiver has been in



PLAN DRAWING OF CHAMBER

WITHIN THE MINE

Below is a view of the foot of the main slope, showing the pitch of the rock strata and the character of the roof in which the upper part of the air receiver bulkhead had to be anchored. At the right of the cars is a 5-foot seam of coal, but its true color is disguised by the limestone dust with which the entire mine is sprayed. The other picture shows the landing parting at the foot of the 6,000-foot main slope. The other end of the parting is at the top of a 5,000-foot auxiliary slope.

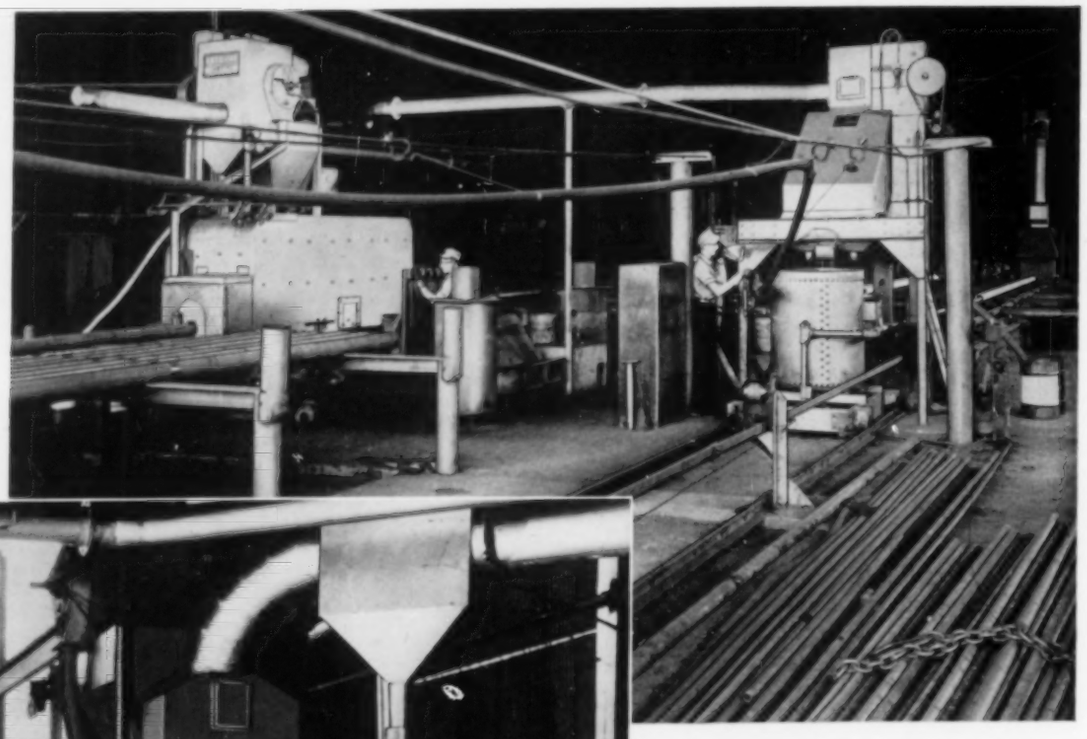
regular service and the air within it has been maintained at a pressure of 60 pounds or higher, not a trace of methane has been detected even though the valve is opened and the discharge tested daily.

The concrete in the bulkhead forms was allowed to set for three weeks, after which grout was forced under 300 pounds pressure through the pipes that had been provided for that purpose. Following a further 3-day period to permit the grout to set, the chamber was given a hydrostatic test at 160 pounds pressure. There was no leakage through the bulkhead, neither was there any sign of it above or below it. However, it was found that some water was passing around the ends of it through a 3-inch band of clay in the coal seam. This appeared to be serious. In an effort to stop the flow, 3-inch angling holes were drilled in the clay band for a distance of 50 feet from the raise below the bulkhead and directed so that they would just miss the ends of the bulkhead. These holes were grouted under about 300 pounds pressure. When the receiver was again charged with compressed air, it was discovered that there was still a leakage of approximately 40 cfm. It was difficult to determine from just where this was coming. Water was again pumped into the chamber, which was already under about 75 pounds air pressure. After it had risen to a point approximately 30 feet up the slope from the bulkhead, it was turned off and permitted to stand overnight. Although water continued to filter out around the ends of the bulkhead at the rate of about 1 gpm., there was no perceptible drop in the air pressure at the end of twelve hours. It has since become apparent that a water seal against the inner side of the bulkhead and extending up along the coal ribs for 30 feet prevents the escape of any appreciable volume of air.

After the chamber had been filled with water for the hydrostatic test, a meter was placed in the drainage line and the measurement of the flow showed the capacity of the receiver to be almost exactly 25,000 cubic feet. At elevation 1,200, where the compressor is located, the compression ratio for 80 pounds discharge pressure is about 6.7 to 1. This means that when the chamber is charged with air at 80 pounds pressure it contains the equivalent of 167,500 cubic feet of free air and that it requires 9.6 hours of work on the part of the 290-cfm. compressor to fill it. Only air above 50 pounds gauge pressure is considered to be useful. That is, if the compressor should stop for any reason the drills could continue to operate but with gradually decreasing effectiveness until the pressure of the air in the receiver fell below 50 pounds. The volume of air that would be withdrawn in the case of a drop in pressure from 80 to 50 pounds would amount to approximately 52,000 cubic feet, which corresponds to a working period of three hours for the compressor.

Under present operating conditions at the mine, the discharge pipe from the receiver is connected with only one of the three 2-inch air distribution lines. At the beginning of the day shift, the receiver pressure is 80 pounds. It has become apparent that most of the drilling is done during the first four hours of that shift, for with the compressor running at full capacity the receiver pressure is lowered as much as 10 pounds at times during that interval. While the drills are idle during the lunch hour the compressor usually begins to build up the pressure, and this continues during the lighter afternoon shift. By the time work stops at 10:30 p.m., the pressure is restored to 80 pounds.

Since the large underground receiver was provided there has been no shortage of air for drilling and, as has previously been mentioned, the service of the 115-cfm. compressor has been dispensed with. Unfortunately, because there was no meter on the compressor motor prior to the construction of the chamber, it is impossible to obtain an exact record of the increase in active working time of the motor and compressor.

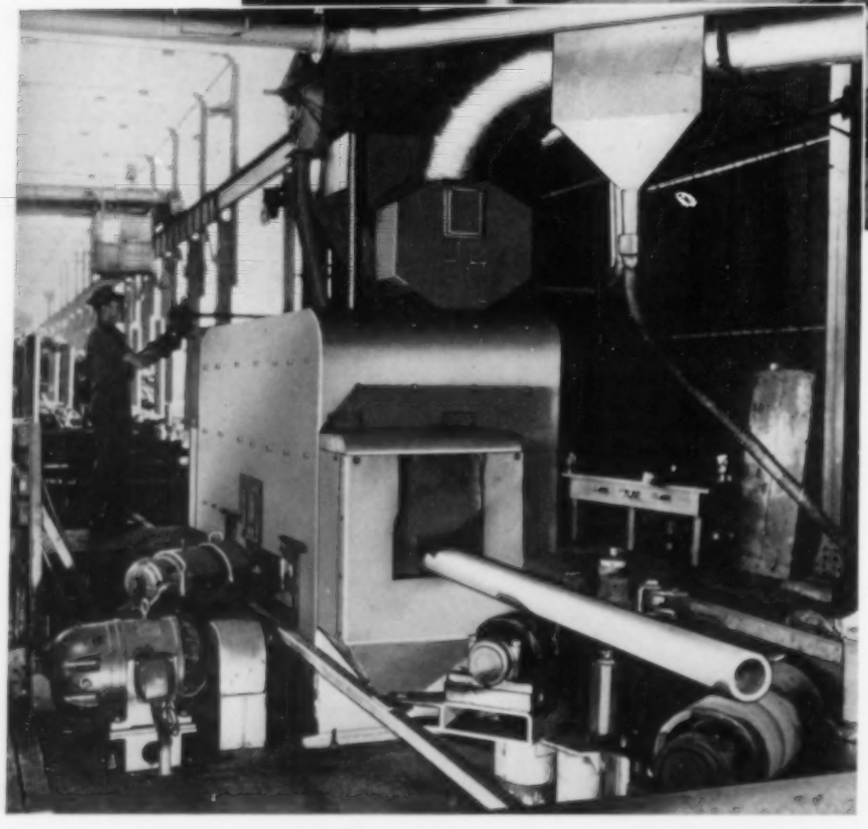


PIPE-DESCALING EQUIPMENT

At the left in the picture above is the Wheelabrator showing a tube entering the cabinet in which the exterior surfaces are cleaned. Alongside is the machine's loading stand. At the right is the air-blast machine that travels on rails and advances with the nozzle which removes the scale from the inner surfaces by a blast of steel grit and compressed air.

Descaling Pipe the Modern Way

A. M. Hoffmann



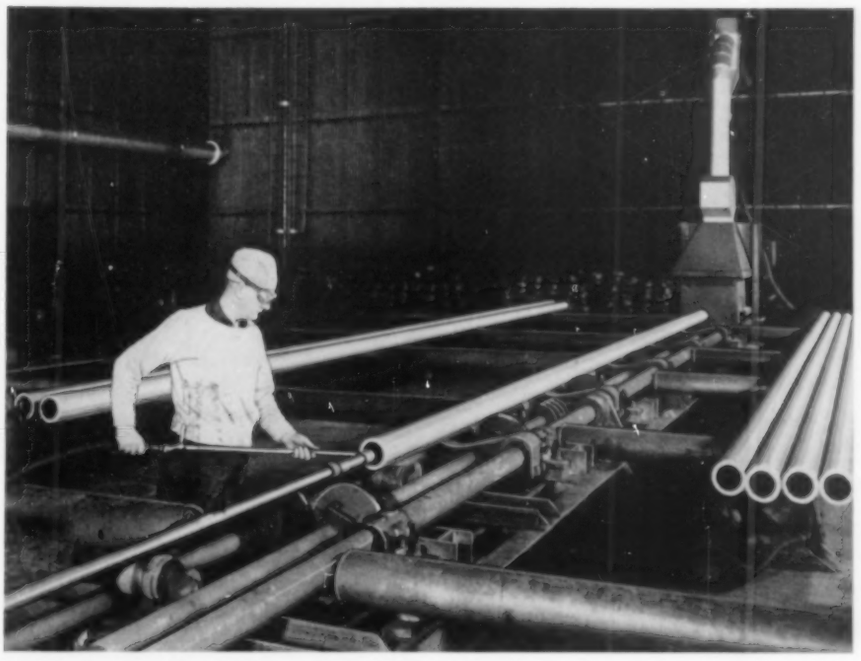
AFTER EXTERIOR CLEANING

This picture shows the discharge end of the Wheelabrator and several of the conveyor rolls that also rotate the tube so as to expose every part of it during its passage through the machine. The flow of the metallic abrasive to the blasting units is controlled by the operator at the left.

ONE of the vexing problems in making seamless steel tubing has been the removal of the heavy heat-treatment scale that forms at nearly every stage in the course of its production. Because of the difficulties involved, it has been the practice of the National Supply Company to have the work done outside the plant, an arrangement that had drawbacks. To assure proper control and close supervision, the company decided to equip its Spang-Chalfant Division for cleaning all its low-carbon and high-alloy seamless steel pipe ranging from 2 to 14 inches in outside diameter and from 18 to 50 feet in length. The machinery in use there today was designed and built by the American Foundry Equipment Company and consists of two units, one for descaling the exterior and the other the interior of the tubing.

The simplest way of describing the procedure and machinery is to follow a tube from start to finish of the cleaning operations. The external scale is removed first by running the pipe through two Wheelabrator blast units housed in a special cabinet. As it passes through on conveyor rolls the tube rotates and is exposed to the direct attack of a metallic abrasive applied from below. The length of time required to do the blasting depends upon several factors and is controlled by changing the skew angle of the conveyor rolls and their speed of rotation.

At the discharge end, the partly cleaned product is automatically rolled off the conveyor on to skids which, in turn, roll it to the air-blast machine that removes the scale from the interior surfaces. This is done by means of a lance-type nozzle that is inserted into the pipe and is long enough to reach from end to end. The work rests on revolving steel disks, and, as it rotates, the nozzle advances, together with the



FINAL STAGE

From left to right are seen the air-blast nozzle ready for insertion into a tube section, the loading and unloading equipment, and the housing from which the spent abrasive is returned by a conveyor to the storage hopper for recirculation. The operator is preparing to blow dirt out of a 5½-inch pipe with a jet of compressed air before starting the nozzle on its way through. Nozzles with one or two orifices are used, depending upon the size of the tubing.

associate equipment. This consists of an air-blast tank and of storage hoppers, all mounted on a car that runs on tracks and is pulled along behind the nozzle. The feed of the latter and the speed of rotation of the pipe can be regulated to meet requirements.

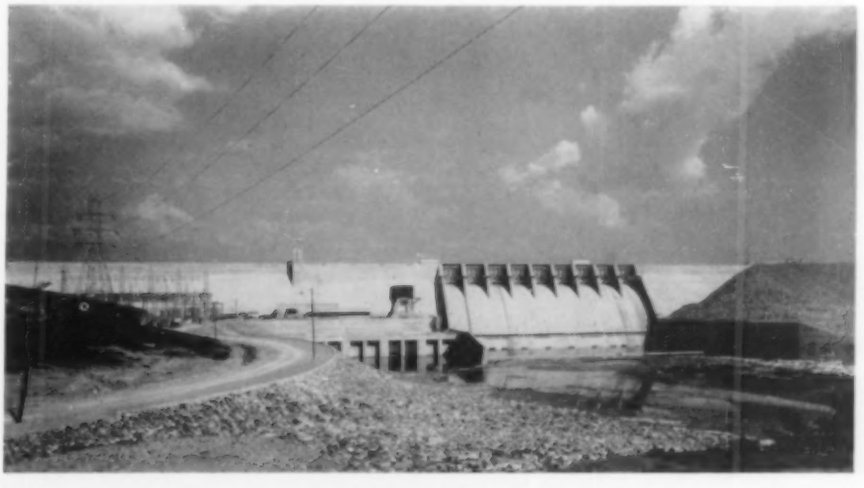
Steel grit is used for descaling and is fed to the nozzle in properly proportioned quantities with air at from 90 to 100 pounds pressure, depending upon the thickness of the incrustation. The spent abrasive is collected at the far end of the tube in a metal housing where it is separated from the air and returned for recirculation to the blasting equipment by a belt conveyor that travels underneath the pipe cleaner. The air is exhausted after passing through a dust collector. With the cleaning finished, the nozzle is withdrawn, the tube is kicked off the disks to nearby skids, and the succeeding length is put into cleaning position. Work is continuous, one pipe following the other in a steady procession.

The system has been operating for about 80 hours a week since its installation. As speed of production is influenced not only by the size of the tube but also by the steel of which it is made and the condition of the scale it is difficult to give basic output figures. However, some idea of what the equipment can be counted upon to do can be obtained from the fact that the exterior surface of 4½-inch standard low-carbon pipe is being cleaned at the rate of 18 feet a minute and the interior at the rate of 14 feet a minute.

Airplane Engines Tested on Ground Under Flight Conditions

ENGINES for airplanes are tested by the Army air force before they ever leave the ground to determine how they will perform in service at different altitudes, temperatures, and humidities. This work is done in laboratories where extremes in atmospheric conditions are created by the use of compressors, vacuum pumps, refrigerating machinery, and electric heaters. What is perhaps the most complete laboratory designed for this purpose is soon to be put in operation in the United States. It will house several chambers in which engines can be tested under different conditions ranging from those prevailing over low desert areas—where the temperature soars to 120°F., where the relative humidity amounts to only 5 to 10 per cent, and where the pressure may rise to more than 29 inches of mercury—to those at altitudes of +40,000 feet where the temperature drops to –67° and where the air pressure falls to 5.54 inches of mercury (absolute).

Initially, each test chamber is supplied with partly conditioned air by a 250-hp. blower. But before it is delivered to the carburetors, its humidity, temperature, and pressure are further regulated until the desired atmospheric condition is reached. If, for example, an engine is to be subjected to extremely low humidity, the temperature is first dropped to a point as low as –70° to remove the moisture by causing it to form snow or frost. After the dried air is reheated to the proper temperature by G-E finned Calrod heaters it goes to the carburetors. Conversely, if the humidity is to be high, steam is mixed with the air. So that flying conditions may be truly simulated, provision is made for cooling and heating the gasoline to –10° and 80°, respectively.



TVA'S CHEROKEE DAM

A general view of the Tennessee Valley Authority's power structure on the Holston River in eastern Tennessee. Closure of the dam was effected late in 1941, and water storage began at that time. Its generators are now contributing current to the TVA system for the operation of vital war industries in the Tennessee Valley. Cherokee Dam is more than 6,000 feet long and rises 175 feet above the bed of the river. Its 31,000-acre lake extends 58 miles upstream.

Gas—Industrial Servant

GAS fuel is becoming increasingly important in our race to turn out munitions and the thousands of other products that are needed to wage war successfully. There are now well in excess of 1,000,000 industrial and commercial users of manufactured and natural gas, or nearly two and one-half times the 1929 number. An increase of 15 per cent in gas consumption was registered in 1941, and the curve is still rising. Fortunately, far-sighted managements in the gas industry started early to prepare for the demands now being made upon them. As far back as 1937 they began providing additional facilities and acquiring knowledge as to how to safeguard their entire systems against air raids, enemy action, and saboteurs. As a result, there has been little real shortage of gas in our large industrial centers, and in some of them considerably greater loads can be handled if the need to do so arises.

We are fortunate in having an adequate supply of gas because it is especially well adapted for use in the particular industries that are essential to war preparation. Virtually every weapon and fighting machine except the airplane is composed largely of steel, a metal that must be heat-treated during the manufacturing processes. It so happens that gas plays a dual role in this connection, being not only a desirable fuel from the standpoint of heating value but also possessing all the properties for creating a suitable atmosphere in which to carry out heat-treating.

As H.E. Way points out in *Domestic Commerce*, the fabricating industry, for example, can with suitable atmospheres "take low-carbon steel, heat and treat it with gas, thereby adding carbon to the steel. The malleable industry takes its castings, which contain detrimental carbon, heat-treats them with gas and removes excess carbon. The steel industry can give its bright sheets a finished anneal in a protective atmosphere without injuring the surface or decarburizing them."

Gas not only does these things and more but it also fits in well with our mass-production methods and makes for speed of manufacture. For instance, 40-ton battleship turrets are now annealed in a single operation, and as many as 10,000 projectiles a day are prepared for forging in a single continuous furnace. A typical bomb-hardening furnace handles fifteen 2,000-pound bombs per hour. A stress-relieving furnace will heat a charge of 675,000 pounds to 1,250°F. in 35 hours from a cold start, while another has an effective loading space measuring 17x10x6 feet and can heat 5,000 pounds of metal per hour from cold to 1,100°F.

These are some of the advances that have been made since the last war when gas was in a more or less pioneer stage as an industrial fuel. Gas is now used effectively to harden armor plate and cartridge cases, anneal gun turrets, forge projectiles, fabricate aluminum, form glass, process minerals and chemicals, and to mold, solder, and rivet airplane and ship parts. The gas industry has conducted extensive research along all these lines during the past two decades and knows how to proceed without consuming valuable time when delays are costly.

Accidents and the War

VOLUNTARY holidays have been infrequent on the American labor front this year, but involuntary holidays caused by accidents have made serious inroads on production and taken an appalling toll of human life. According to the National Safety Council, 85,000 persons have been killed and 7,700,000 injured since the Pearl Harbor attack. Aside from the tragic aspects of this lamentable record, it also has cost the war effort 410,000,000 man-days of lost work. Translated into terms of tanks, planes, guns, and ships that might have been turned out if this labor had been available, the enormous slowing effect of accidents upon the coming of the day of peace can be comprehended.

Forty-two thousand of those killed were workers, but three out of every five sustained their fatal injuries while away from their jobs. It is apparent, therefore, that safety campaigns in industrial plants alone are not sufficient to safeguard the well-being of employees. The effort must reach out to cover the hours spent at home, in recreation, and in traveling to and from places of work. A step in this direction is now being taken at the direct request of President Roosevelt and of leaders of our war-preparation agencies. The President called upon the National Safety Council "to mobilize its nation-wide resources in leading a concerted and intensified campaign against accidents."

To carry out this assignment, the council is promoting a "War Production Fund to Conserve Manpower." It is seeking to raise $5,000,000 from American industries to finance the movement. William A. Irwin, former head of the U.S. Steel Corporation, is serving as national chairman of the fund, and Thomas W. Lamont of J.P. Morgan and Company is treasurer. A national committee of 600 persons and an executive committee of 74 have been formed. Already more than $2,000,000 has been given or pledged.

The major objectives of the campaign will be: to reduce as quickly as possible work accidents in war-production industries (only one out of eight of our 196,000 industrial establishments is fully covered by a safety program); to reduce the off-the-job accidents in war-production areas and communities; and to cut down accidents among other population groups where needless deaths and injuries indirectly affect the war effort.

It goes without saying that the preserving of lives in industry will save other lives later on the fields of combat. Nothing should be left undone that will put a staying hand upon this aptly named "saboteur of manpower"—the accident.

Log of Our War Economy

THE following paragraphs contain significant bits of information culled from official press releases sent out by the War Production Board.

OCTOBER 23—The first important molybdenum discovery in many years has been reported from Canada and will augment the United Nations' supply at a time when it is badly needed. The new ore body was found only 1,500 feet from a location where extensive unsuccessful development work was done during the first World War. The deposit is at least 400 feet long and 200 feet in vertical thickness.

OCTOBER 29—Users of wooden packing boxes were urged to investigate the possibility of utilizing paperboard containers to save lumber and steel products such as wire and nails. The salvage and repair of old boxes and crates were also suggested. Wooden containers will utilize 200,000 tons of steel and almost 9,000,000,000 board feet of lumber this year. The 1943 figures will be even higher, unless consumption is restricted.

NOVEMBER 2—Extension to the eastern coast of the "Big-Inch" pipe line (described in our November issue) for transporting crude oil and fuel oil from Texas was authorized.

NOVEMBER 4—Manufacture of safety razors for other than the armed forces, export, and Lend-Lease was prohibited, although stocks in the hands of distributors may be sold without restriction. The 1943 production of razor blades was limited to 80 per cent of the 1941 output, when more than 3,000,000,000 were made. These restrictions will save some 800 tons of steel, much of it of the high-carbon variety.

"I can't get you a saw without a priority."

NOVEMBER 8—Controlled Materials Plan is the name of a new system for distributing essential materials to industry that will become fully effective by mid-1943. It is designed to control the flow into war production of three basic metals—steel, copper, and aluminum.

NOVEMBER 9—The hiring of more Negro workers was urged as a means of solving the labor-shortage problem. Of the 13,000,000 Negroes in the nation, 5,000,000 are workers. A pamphlet setting forth the salient facts concerning the reserve supply of colored labor is being mailed to 30,000 war-production contractors.

NOVEMBER 10—More than half of Canada's production of war supplies is being sent to Great Britain and the United States. Up to October 1, the United States had placed $900,000,000 in war orders in Canada during 1942, and the Dominion's total war orders since July, 1939, have amounted to more than $5,000,000,000. Canada now has a representative on the Combined Production and Resources Board, along with Great Britain and the United States. He is the Hon. C. D. Howe, American-born minister of munitions and supply. As head of a large construction firm, he built many grain elevators in western Canada, and in 1930 he visited Argentina to advise that country regarding her grain-elevator system.

NOVEMBER 12—Nearly 80,000 business firms have reported 100,000 tons of idle copper and copper alloys in response to a Government appeal. Nearly two-thirds of the metal has been voluntarily offered for sale, and three-fourths of that has already been allocated to war production. Holders of 32,000 tons have so far refused to sell, and the Government will institute requisitioning proceedings wherever such action is found necessary. Stressing the need for copper, a WPB spokesman pointed out that a 37-mm. antiaircraft gun uses a ton of that metal every twenty minutes it is in operation.

Only one type of barbed wire can hereafter be made, compared with eight formerly obtainable. By standardizing on one type, more wire can be made from each ton of steel. The average annual consumption of steel for wire, wire fencing, and netting in the past five years was 496,000 tons.

A new appeal was issued to business firms to relinquish typewriters for the use of the armed services and key governmental agencies. There are 2,400,000

"Good news, boys! WPB is going to let us have lumber for a barricade."

machines in the hands of the public, and the Government wants one out of every four of them. Only typewriters built since January 1, 1935, are requested. Detailed suggestions for getting along with fewer machines have been issued to business concerns in the hope that they will bring about the release of some of those machines.

NOVEMBER 16—The reforestation program that was initiated two decades ago is paying dividends today, according to Nathaniel Dyke, Jr., technical consultant to the Lumber and Lumber Products Division of WPB. The current shortage of metals has brought about an increased use of wood for a great diversity of purposes, and our forests can, fortunately, provide enough lumber to meet all needs. The application of the science of chemistry to forestry has resulted in many new wood products. Lignin, which paper mills considered waste for many years and which polluted streams and killed fish, has been revealed to be a valuable raw material for making plastics. Sawdust and other by-products that were formerly discarded and that aggregate 500,000,000 tons annually are serving to make fiberboard, alcohol, vanillin hog feed, and even sugar. The time is fast approaching when the entire tree will be utilized. Various wood products, including structural members of training airplanes and containers to replace metal ones, are contributing importantly to our war effort.

NOVEMBER 20—As of November 1, a total of 23,400,000 persons in the United States were buying War Savings Bonds under payroll savings plans. This was an increase of 2,000,000 since October 1. Included in this number are 19,000,000 employees of private firms, 2,400,000 workers in Government agencies, and 2,000,000 persons in the armed forces of the nation.

AT "E" CEREMONIES

The picture at the left was taken at Painted Post, N.Y., right after Col. J.S. Seybold, U.S.A., had presented the "E" pennant to Gen. Mgr. E.J. Smith. Those with a hand on the pennant are, left to right: Mr. Smith; D.R. Lowry, I-R vice president; Colonel Seybold; and Irving J. Reynolds, who accepted the "E" lapel pins for the employees. Below is a similar scene at the Phillipsburg, N.J., ceremony. From left to right: Rear Admiral W.C. Watts, U.S.N. (Ret.), who presented the pennant; Mayor Joseph Morrison of Easton, Pa.; P.J. Bentley, general manager of the plant; Capt. A.J. Wellings, U.S.N., who presented the "E" lapel pins; Michael Dowd, who accepted the pins; and Col. C.F. Stanton, U.S.A.

All I-R Plants Fly Army-Navy "E"

DURING November, the Army-Navy "E" pennant denoting excellence in war production was awarded to both the Phillipsburg, N.J., and the Painted Post, N.Y., plants of Ingersoll-Rand Company, manufacturer of compressors, rock drills, pneumatic tools, pumps, oil and gas engines, condensers, and other industrial and construction equipment. The Athens, Pa., factory of the company received the honor on August 24, and the "E" insignia, that has so far been given to only 2 per cent of the nation's war plants, now flies over all the I-R shops.

The ceremony at Phillipsburg was held on November 6, when Rear Admiral William C. Watts, U.S.N. (Retired), presented the "E" pennant to P.J. Bentley, general manager of the plant. Capt. A.J. Wellings, U.S.N., made a token presentation of "E" lapel pins to eleven shop-division representatives whose length of service with the company aggregates 426 years. They were accepted by Michael Dowd, who began working for the company 51 years ago.

At Painted Post, on November 23, Col. J.S. Seybold, U.S.A., presented the pennant to E.J. Smith, the plant's general manager. The "E" lapel pins were presented by Lieut. Commander E.W. McKinley, U.S.N. (Retired), and were received on behalf of all the employees by a committee of four workmen whose combined service with the company numbers 163 years.

Engineer Proposes to Extract Oil Direct from Shale Beds

WHILE we have not yet reached the stage where we have to depend on our huge oil-shale reserves for petroleum and its derivatives, nevertheless it is interesting to know what other less-favored countries are doing in developing their resources. In the Naerke district of Sweden are deposits with an estimated reserve of 100,000,000 tons of oil. These beds have an average depth of from 55½ to 59 feet and have not been exploited in the past because the oil content, even in the richest of them, does not exceed 6 per cent. Now, with the sources of supply cut off, plans are on foot to develop them by a unique method of extraction conceived by Dr. Fredrik Ljungstroem, a well-known engineer and fuel technologist.

The idea is to expel the gas and oil vapors from the shale in place by boring numerous vertical holes in the beds. In some of these are to be installed electric heating elements, while the others are to serve as reservoirs for the oil and vapors which are to be conveyed from there direct to condensers. The heating units are to be arranged in the form of a hexagon and spaced so that there will be one for every 107½ square feet of surface. So disposed, it is estimated that each would heat 400 tons of shale sufficiently for extraction in 2½ months with a consumption of 40,000 kw. However, for production at a cost commensurate with that of imported crude, it is proposed to do the work with 10,000 kw. On that basis it would take a year to recover the oil from 1,000,000 tons of shale. This is equivalent to 6⅔ acres, and would require the drilling of 2,700 holes equipped with heaters. It is claimed that the area would yield 30,000 tons of oil.

Plastic Window Panes a Safeguard in Air Raids

FOR industrial plants in potential air-raid zones and for military construction purposes, the Monsanto Chemical Corporation has developed a window-pane material that is said to withstand the shattering force of a 150-pound bomb exploding 8 feet distant. It is designed primarily as a protection against flying glass, one of the chief dangers in a raid, and consists of standard 16-mesh wire screening sandwiched between two sheets of a transparent cellulose-acetate originally developed for fluorescent lighting fixtures. It is as clear and transparent as a screened window of glass and installed as easily.

According to the company, the material sustained little damage when tested under a 28-inch vacuum. Clear glass and heavy wire-reinforced glass, by comparison, shattered when exposed to a vacuum of 15 and 26 inches, respectively. In the case of a drop test at the Navy's Bureau of Yards and Docks, ordinary glass was smashed by a ¼-pound ball falling from a height of 20 inches, whereas it took a 2-pound ball, dropped from a height of 42 inches, to penetrate a pane of the reinforced plastic. At that, the missile left a clean-cut hole which could be patched with cellulose tape with the window suffering little loss in breakage resistance.

The bomb-resistant plastic can be drawn or formed into any desired size and shape. It is available in eight standard panes of which the smallest is 9½ inches square and the largest measures 19½x24½ inches. They are provided with a ¼-inch flange to permit stapling to wood sash. The product has been named Vuelite.

Improvised Oil Carrier

BY THE use of synthetic-rubber cells, a 50-ton box car has been converted into a tank car which recently made an experimental 700-mile run from Indiana to Washington, D.C., loaded with 5,000 gallons of oil. The modified car is offered as a means of relieving the petroleum shortage on the east coast until the completion of the 24-inch pipe line from Longview, Tex., to the Atlantic seaboard, a distance of 1,407 miles. It was sent to Washington for inspection by Joseph B. Eastman, director of defense transportation, and other Government officials.

The Mareng Cell, as it is known, is made of Thiokol and was developed by the Glenn L. Martin Company. Each has a capacity of 2,500 gallons and, when filled, has the appearance of a huge packing case. A 50-ton car can accommodate six such units; but in the case of the trial run only two were in service. These, however, were placed directly over the car trucks where they would be subjected to maximum vibration. The containers are all loaded by one pipe in the top of the car, and a single discharge valve in the bottom serves to empty them. The cell is the outgrowth of the self-sealing, rubber fuel tank for airplanes. When not in use it can be collapsed and rolled up for return shipment.

Air-Operated Earth Borer and Excavator

DIGGING holes for telephone and telegraph poles, fence posts, and the like has become an easy operation as a result of the development of a pneumatic machine that bores the hole and excavates the material at the same time. Basically, it consists of a drill stem with a Link-Belt screw conveyor and of a hardened-steel cutting head. The unit is operated by means of a Multivane reversible air drill that is independent of the tool and can be used for various other purposes such as drilling holes in timbers, structural steel, etc. A portable compressor supplies the necessary air.

EARTH DRILL AT WORK

This picture shows the tool complete with portable compressor. The man at the left controls the valve that supplies the air and also helps to guide the machine. The unit is operated by a Type 44 SM Multivane, reversible drill and has a 12-inch-diameter screw conveyor. Note how the latter brings the excavated material to the surface and dumps it neatly around the opening of the hole while boring is in progress.

The K-M Earth Drill, as it is designated, is a product of Ka-Mo Tools, Inc. It is furnished in different sizes suitable for boring holes from 5 to 12 inches in diameter and 5 to 6 feet deep. These are adequate for most purposes, but greater penetration can be obtained by the use of additional drill lengths. Two men are needed to guide the machine, which can bore holes at an angle and in cramped or otherwise inaccessible quarters, thus enabling it to work under viaducts and fences, on steep embankments, or in ditches. The cutting head is provided with an adjustable blade that makes it possible to operate in mud, sand, or clay without grabbing. The blade is of tool steel and has stellite cutting edges in order to increase its service life and to facilitate excavating.

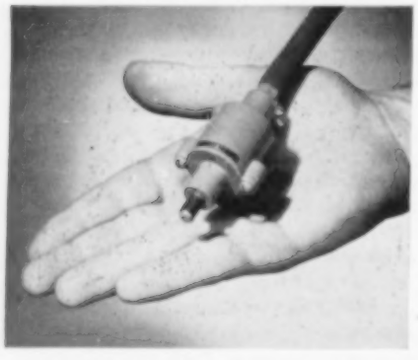
The drill is filling a long-felt need for a compact, easily handled tool to expedite the boring of holes, and is in especial demand today because of the numerous factories engaged in war work, military camps, airports, and defense areas generally that are being fenced in to prevent encroachment by unauthorized persons. For example, at the Great Lakes Naval Training Station, the Cyclone Fence Company set up 27,000 feet of fencing in ten days with the aid of one 12-inch-diameter K-M Earth Drill. The latter is also helpful in dynamiting tree stumps, in clearing land, as well as in feeding and planting trees, while trouble shooters of public utilities, whose emergency trucks carry compressors and air-operated tools, are using them in the work of searching for gas or water leaks.

Industrial Notes

Dextrin, starch, and corn sugar are yielding a glycerin substitute that bears the trade name of Akerite. The liquid is said to be nontoxic; to have a freezing point below zero Fahrenheit; to be soluble in water, alcohol, and glycerin; and not to deteriorate in storage.

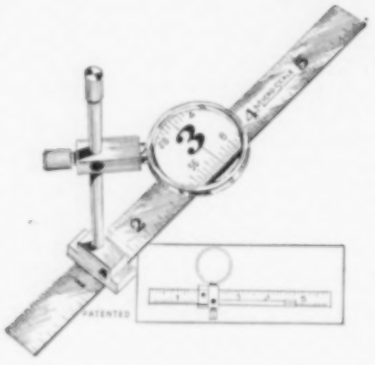
Liquid Linoleum is a semifluid substance for surfacing concrete floors. It is said to fill the pores and to produce a thick coat which, as the name implies, has the appearance of linoleum. It is flown on and spread with a flat tool, drying in approximately half an hour ready for foot traffic. Further claims are that it is resistant to attack by acids, alkalies, and oils.

Little, but oh my! might be said of the Midget air clamp just announced by Mead Specialties Company. Although so small that it has plenty of room in the palm of the hand, its holding power is said to be surprising. It is designed expressly for the aircraft industry but is suitable anywhere for light assembly jobs involving welding, riveting, or bolting. The device exerts 80 pounds pressure per square inch when actuated with air at 100 pounds line pressure, and for bench jobs can be controlled by a foot valve to leave the hands free. The ram has a stroke of 5/8 inch and is withdrawn by an internal return spring when the air is exhausted from the cylinder. In the case of a set-up calling for the use of multiple clamps, all of them can be controlled by a master valve, both lock-up and release being instantaneous. Or, where certain primary numbers require locking up before secondary numbers are laid in, the former can be actuated by one master valve and the latter by another, etc.



A new paint remover, known as Stripper No. L-595, has been put on the market by Turco Products, Inc. The liquid is applied by brush or air spray and causes the coating to swell immediately, it is claimed, except in the case of baked, synthetic enamels which come loose in about fifteen minutes. In that condition the paint, etc., can be easily scraped off by mechanical or other means. Further cleaning of the surface is not required. The remover is noninflammable and nontoxic, and does not attack metal or nonmetallic materials other than rayon.

Inspectors, toolmakers, and other precision workers will be interested in the Micro Scale which is being distributed by L. V. Fox Company, Inc. This magnifying scale lies flat on the surface block and is provided with an unbreakable plastic lens that is focused upon and slides along the scale. With it such a fine division as a sixty-fourth can be seen about four times its normal size, thus permitting it to be split with the scriber or enabling the user to work without difficulty to a few thousandths of an inch. The scale can be carried flat in the pocket.



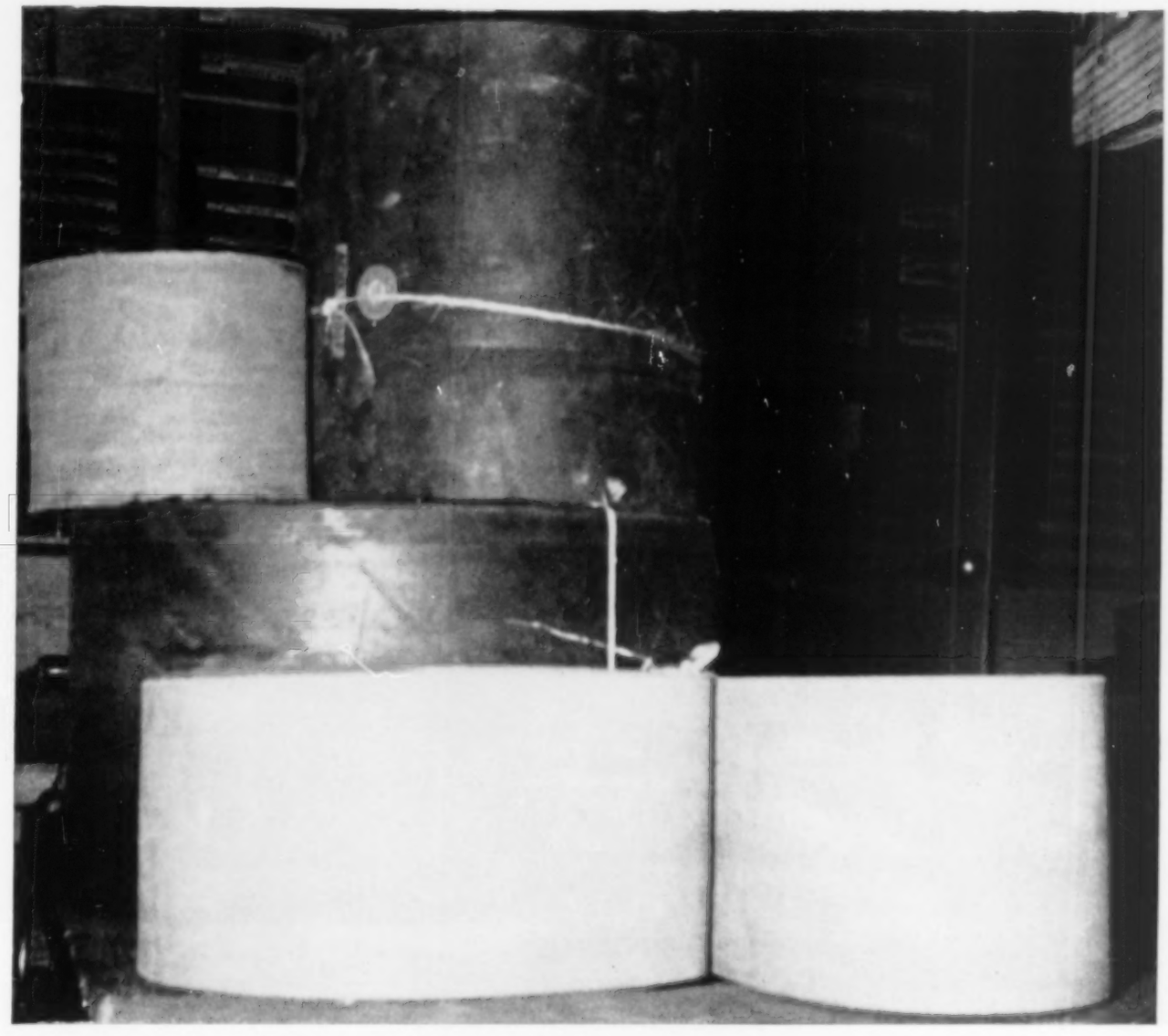
The recovery of copper from iron and steel scrap has been put on a highly efficient basis through the development of a new deplating process. The discovery, says *Domestic Commerce*, serves a double purpose in that it makes both copper and large quantities of strip steel and iron available for use. Virtually 100 per cent of the copper is salvaged in a form suitable for the immediate electroplating of parts for military equipment.

Denmark has launched a 3,000-ton freighter driven by a 4-cycle, 950-hp. diesel engine using producer-gas instead of oil. The fuel is generated on board ship by burning coal. While the first cost of the propulsive machinery is greater than that of a steam installation, it is said to have a number of advantages over the latter. It occupies less space, to that extent increasing the vessel's carrying capacity. In addition, the coal consumption per horsepower is said to be from 15 to 20 per cent less, thus reducing the operating cost.

Air Filtration and Dust Control is the title of a 31-page booklet just released for free distribution by the American Air Filter Company, Inc., of Louisville, Ky., which has had many years of experience in this field of engineering. The brochure covers both atmospheric and process dust and deals comprehensively with the more general industrial-dust problems and their solutions. Included are chapters, well illustrated, on filtered air for air conditioning, ventilation, drying operations, product finishing, for the control of bacteria and mold spores, for cooling electrical equipment, for the protection of engines and air compressors, etc.

Maps and aerial photographs of all areas outside the continental United States are wanted by the Army Corps of Engineers. Individuals and companies possessing such maps or pictures have been requested to notify the Foreign Map Section of the Corps of Engineers, U.S.A., at any of the following addresses. Copies will be made and the originals returned. New York, N.Y., 1270 Sixth Avenue, Room 820. New Orleans, La., Maritime Building, Room 900-A. San Francisco, Calif., 74 New Montgomery Street, Room 546. Intelligence Branch Office, Chief of Engineers, U.S.A., New War Department Building, Room 3168, Washington, D.C.

All loose blade studs and threaded tension devices have been eliminated in a new type of hack-saw frame recently introduced by Victor Saw Works, Inc. The blade is released or secured by a simple cam-action lever lock in a fraction of the time usually required and can be repositioned to face in any one of four directions by the use of either of two sets of fixed pins. To adjust the length for an 8-, 10-, or 12-inch blade, it is necessary merely to pull out a pivot pin, slide the frame forearm in or out to the desired length, and snap the pivot pin back into place. There are no loose parts to drop out, and the frame will not jackknife when the blade is removed. The Victor Frame is made of heat-treated spring steel with gun-metal finish and is available with a pistol grip or a straight handle molded of heat-resistant Tenite—a nonconductor of electricity. It is said to be more rigid than any other adjustable frame, thus permitting high blade tension with resultant straighter cuts and fewer broken blades.



Found! Rubber in coal mines and quarries

Another B. F. Goodrich suggestion to save rubber

SAVING rubber today is just like finding it — and rubber can be saved in every plant where belts are used.

Take the case of a West Virginia coal mine. They had three old and worn belts, containing about 44 pounds of rubber, which ordinarily would have been thrown away. The B. F. Goodrich distributor suggested salvage of these belts for use on other drives — and here is what they made.

Original Belts	*Made Into*
2—10-in. 7 ply	1—3½-in. 5 ply—open end
1—12-in. 7 ply	1—4-in. 5 ply—open end
	1—3½-in. 5 ply—endless
	2—6-in. 5 ply—endless
	1—8-in. 5 ply—endless

Out of the original discarded belts came 6 new serviceable belts (80% or 35 pounds of the original rubber was salvaged).

B. F. Goodrich Plylock splice may help you FIND rubber in your plant

Converting old belts into new is a practical, easy way to salvage rubber. Frayed edges can be trimmed, worn plies stripped off, damaged spots repaired, and the patented Plylock splice can make them endless *on the job.* Most B. F. Goodrich distributors are equipped with portable electric vulcanizers and with their knowledge of how to make the Plylock splice, can convert old belts and also do away with metal fasteners.

Before you discard any old belting call your nearest B. F. Goodrich distributor for his advice. (Write us if you don't know his address.) Also write us for a series of folders filled with helpful tips on how to conserve all the industrial rubber products you have. For users of conveyor belts, we will also send on request a special illustrated Belt Maintenance Manual. *The B. F. Goodrich Company, Industrial Products Division, Akron, Ohio.*

B.F. Goodrich

FIRST IN RUBBER

Control...

THE CRITICAL FACTOR IN TRANSPORT PLANE OR STEEL CASTING

WHEN the transport plane ferries its cargo of men or materiel across the skies, lives or equipment hang by delicate threads of control. For the heart of the huge freighter of the clouds lies not in the wingspread or motor, but in the instrument panel.

In this war, control plays a part it never before achieved . . . and plays it not only on battlefields and transportation routes but also on the industrial front where equipment is made.

The Lebanon Steel Foundry stresses control practices in the production of Circle Ⓛ Castings. One of the most important of these practices is heat treatment. The heat treatment of every Circle Ⓛ Casting is controlled to meet definite physical specifications.

Lebanon adapts the method of heat treatment to the size, shape and composition of the casting. Practices include normalizing . . . annealing . . . liquid quench (in water or oil) . . . and tempering. Castings just removed from the heat treating furnace and about to be oil quenched are shown in the photograph. Lebanon heat treating furnaces, of various types, are equipped with the most modern temperature controls.

Because Circle Ⓛ Castings play vital roles in American war operations, Lebanon considers it a duty to pay the premium casting soundness demands . . . control of foundry practice at every possible step. That's why Circle Ⓛ Castings are worthy to serve such foremost industrial organizations as Terry Steam Turbine and Lukens Steel.

Lebanon metallurgists have had close contact with war production requirements since the beginning. Their experience in solving today's type of industrial problem is available to interested organizations.

LEBANON STEEL FOUNDRY · LEBANON, PENNA.

ORIGINAL AMERICAN LICENSEE GEORGE FISCHER (SWISS CHAMOTTE) METHOD

LEBANON *Stainless and Special Alloy* **STEEL CASTINGS**

CIRCLE L

• *Built by* INGERSOLL-RAND CO.

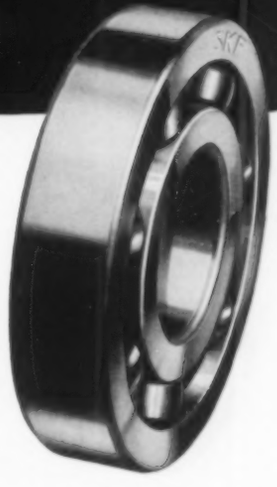
SKF

BALL AND ROLLER BEARINGS

Oil

MOVES *FAST*

with SKF *-equipped* PUMPS



Hurrying oil from a hole in the ground to the engines of warplanes takes everything a pump can give these days. And this RT Pipe Line Pump, driven by a Diesel engine through step-up gears, has everything it takes to do the job *right.* It has SKF Bearings to keep its shaft properly aligned . . . to work faithfully without needing attention . . . to assure long life of rotating parts, high capacities, heads running up to hundreds of feet—all without bearing trouble. Any machine that doesn't stop for trouble can devote full time to production. 5172

SKF INDUSTRIES, INC., FRONT ST. & ERIE AVE., PHILADELPHIA, PA.

Vogt

for better DROP FORGED STEEL *Fittings*

in SOCKET WELD *and* SCREW END TYPES

SOCKET WELD TYPE

Schedule 40—(Standard)
Schedule 80—(Extra Heavy)
Schedule 160 & Double Extra Heavy
Sizes 1/4" to 6"

Choose either type with Confidence, when Drop Forged by **VOGT!**

Vogt drop forged material is uniform in structure, fine grained and free from porosity, with a "plus" of strength and toughness that safely withstands the strains and shocks of service at high temperatures and high pressures. Ells, Tees, Crosses, etc., are available in various alloys to meet any of your special service conditions.

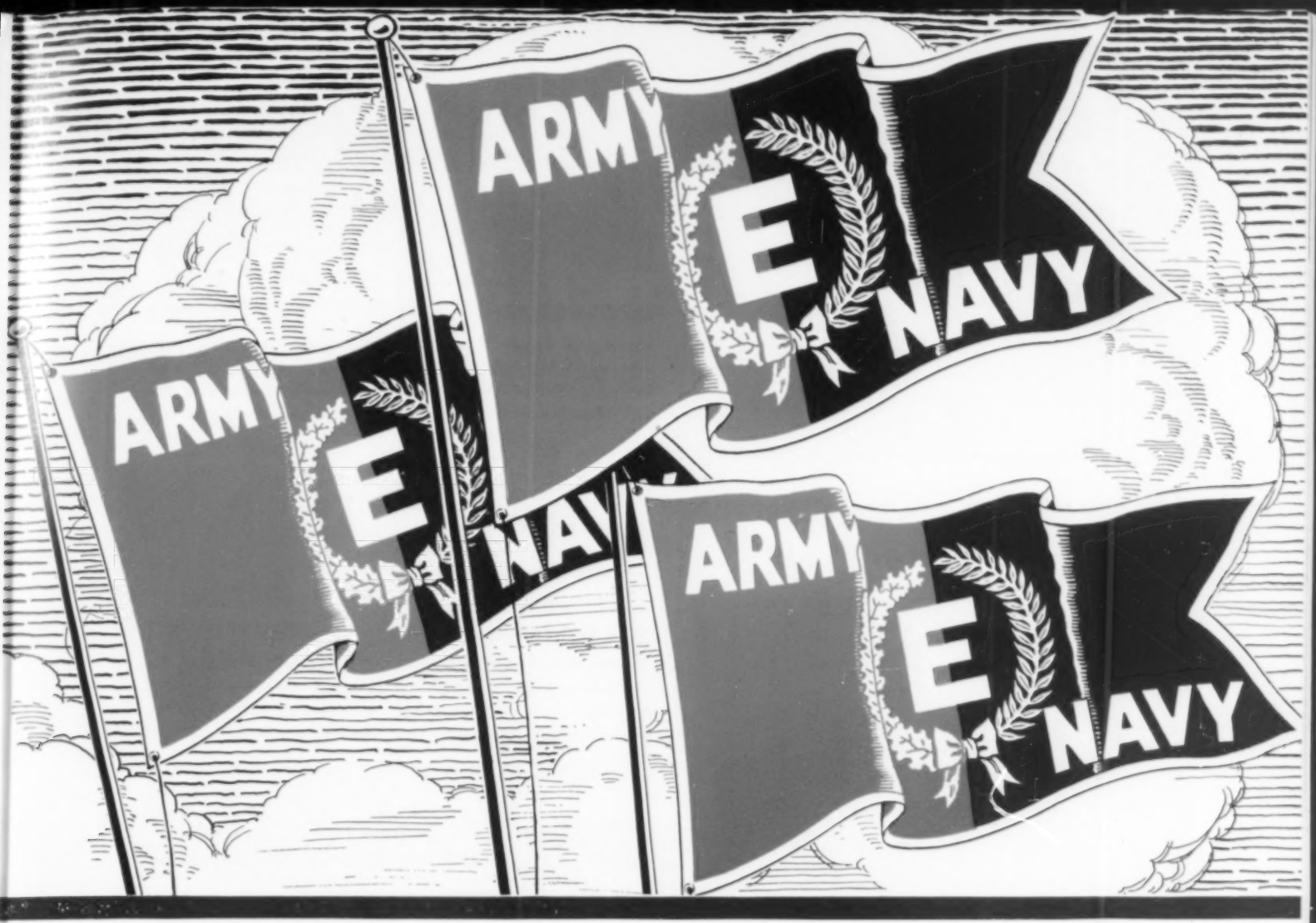
WRITE FOR BULLETINS OR ANY SPECIAL INFORMATION

SCREW END TYPE

2000 pound 3000 pound
6000 pound
Sizes 1/8" to 6"

HENRY VOGT MACHINE CO., Incorporated, LOUISVILLE, KY.

BRANCH OFFICES: NEW YORK · PHILADELPHIA · CLEVELAND · CINCINNATI · ST. LOUIS · CHICAGO · DALLAS



THREE PENNANTS FLY IN RECOGNITION OF

"High Achievement in the Production of War Equipment"

The employees of *all* Ingersoll-Rand plants won these Army-Navy "E" Awards for their high achievement in building equipment needed to win this war.

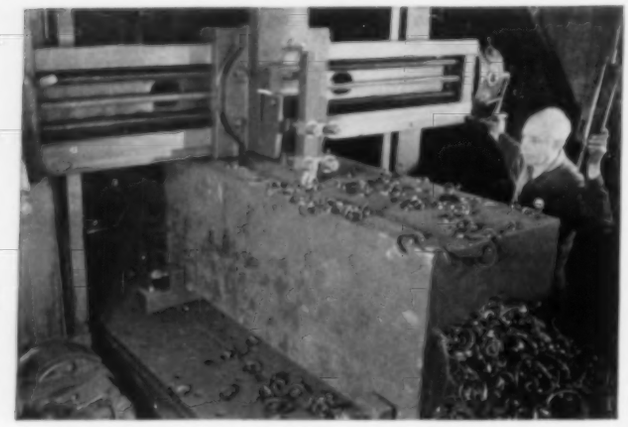
These men and women are turning out the Ingersoll-Rand machines urgently needed by our combat forces. They are also rushing through the I-R equipment that is vital for the production and operation of

Airplanes . . . Fighting and Cargo Ships . . . Tanks . . . Ammunition . . . Synthetic Rubber . . . Aviation Gasoline . . . Airfields, Bases, Roads and Bridges . . . Metal and Coal Mining . . . Railroads . . . Iron and Steel Mills . . . Machine Shops . . . Oil Production, Refining and Pipe Lines . . . Power Plants . . . Textiles . . . Foods . . . Process Industries . . .

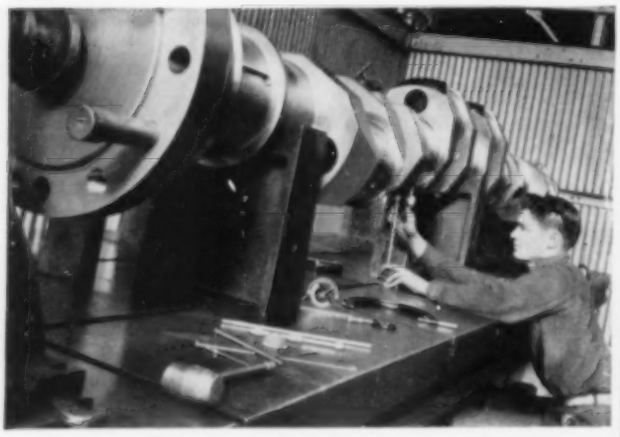
COMPRESSORS
TURBO BLOWERS
CENTRIFUGAL PUMPS
OIL AND GAS ENGINES
ROCK DRILLS
AIR TOOLS
CONDENSERS

Ingersoll-Rand

11 BROADWAY, NEW YORK, N. Y.



QUALITY IS A DECISIVE FACTOR *in War or Peace*



★ In America, it is traditional that Quality and Leadership go hand in hand. Thus it was taken for granted that as war forced the nation to "draft" its production facilities, those companies who had a long established reputation for Quality would be in the forefront of war production.

That definitely was the case with heavy duty steel forgings. Having handled important government work as far back as the last war, National Forge was already "in service" when the war clouds gathered. And the important assignments it has received since have made it more obvious than ever that if the forging is heavy duty it should be National Forged.

NATIONAL FORGE
& ORDNANCE CO.
IRVINE, WARREN COUNTY, PENNA.
"WE MAKE OUR OWN STEEL"

For Excellence in Production

★

Awarded for sustained excellence May 23, 1942

COMPRESSOR EQUIPMENT

STURDY • SOUNDLY DESIGNED

JARECKI VALVES
Sizes and types to meet every condition, each soundly built, perfectly threaded and individually tested.

ERIE UNLOADER
Maintains constant pressure by governing inlet of compressor. Loads and unloads without shock or strain.

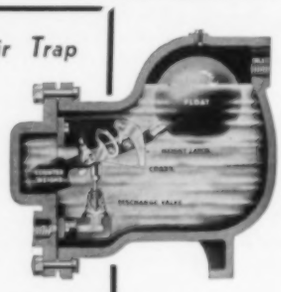
ERIE GOVERNORS
For steam engines, pumps or compressors. For speed control only or for combined speed and pressure control.

JARECKI FITTINGS
Air-furnace malleable fittings . . . close-grained, cast iron fittings, all with perfect threads. A complete line.

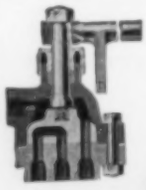
JARECKI Manufacturing Co.
ERIE PENNSYLVANIA, U.S.A

Here's A Compressed Air Trap that Opens Quickly and Closes Tightly

NICHOLSON "JR" MODEL COMPRESSED AIR TRAP



Float-actuated, but not float operated, to permit rapid opening and closing of valve for automatic and trouble-free drainage of water and oil from Air Tanks, Separators, Receivers, Aftercoolers, etc. One pattern size only with either ½", ¾" or 1" inlet and ½" outlet. Pressures to 125 lbs. Other models for pressures to 1500 lbs. Bulletin No. 941.



SEE OUR CATALOG IN SWEET'S

For Quick and Dependable Control 2-3-4-Way Flat Disc Type AIR CONTROL **VALVES**

Non-corrosive metals used in all vital parts for smooth operation. Accurate regulation for single or double acting Air, Water, Steam or Oil cylinders. Bulletin No. 140.

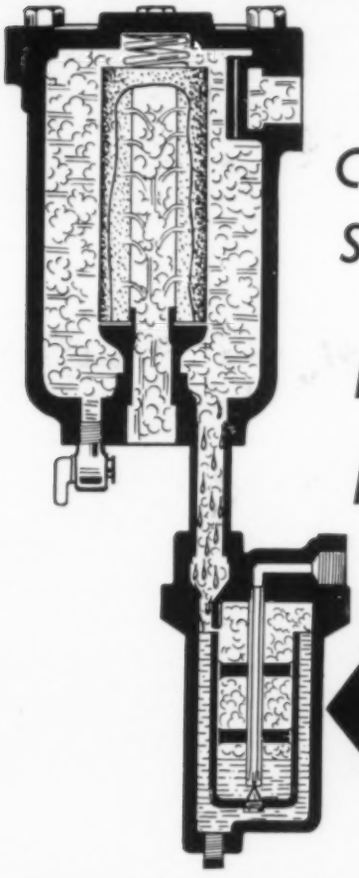
W. H. NICHOLSON & CO. 180 Oregon St. Wilkes-Barre, Pa.

Air Separators, Steam Traps, Flexible Couplings, Expanding Mandrels, Steel and Stainless Steel Floats, etc.

For Maximum Cleanliness

in Compressed Air Systems

PORO-STONE FILTRATION



Provides

Efficient Centrifugal Separation

PLUS

Diffusion and Filtration

Automatic **TRAP** *for continuous Efficiency*

Removes OIL, WATER and PIPE SCALE

Compressed air systems must be kept free of contamination to maintain the efficiency of pneumatic tools and, as with paint spraying and similar operations, to prevent transfer of impurities to the finished product. The Adams Poro-Stone Filter fulfills these requirements efficiently, completely and at low cost. Check these 5-point Adams superiorities.

(1) COMPLETE REMOVAL OF IMPURITIES—Special combination of centrifugal separator for gross impurities and diffusion of fine particles thru filtering medium insures thoro cleansing of air.

(2) MINIMUM PRESSURE LOSS—Efficient designing permits free passage of air during filtering, with less than 1 pound pressure loss.

(3) AUTOMATIC TRAP—Eliminates attention and assures continuous and efficient filter operation.

(4) NO REPLACEMENTS—Life long service from filter tube in removing oil, water and pipe scale. Can be repeatedly cleaned.

(5) NO MAINTENANCE—Designed and built to render continuous service free from maintenance problems.

Complete data yours for the asking! Write for Bulletin 104 today.

R. P. ADAMS CO., INC.

69 Chicago Street Buffalo, N. Y.

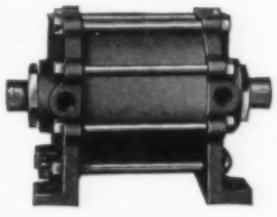
ADAMS *Poro-Stone* **AIR FILTER**

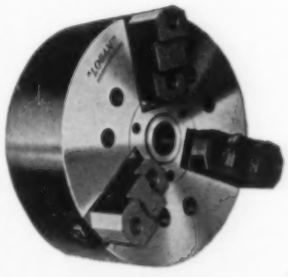
"LOGAN" AIR EQUIPMENT

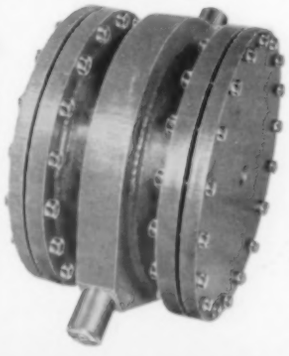
Saves TIME ★ EFFORT MOTION

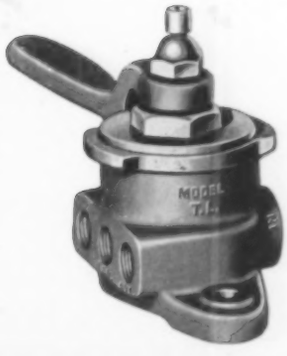
THOUSANDS of uses have been found for "LOGAN" Air Equipment and Controls in the leading industrial plants of the world. Easily adaptable to all types of production machines, this equipment meets fundamental needs, furthers progress and translates today's production problems into tomorrow's increased production. And now in these days of great stress, "LOGAN'S" entire resources and manpower are being devoted to the defense of America in her hour of greatest need. "LOGAN" Equipment is designed to save TIME, EFFORT AND MOTION. Let "LOGAN" Representatives and Engineers make recommendations on your production problems.

★









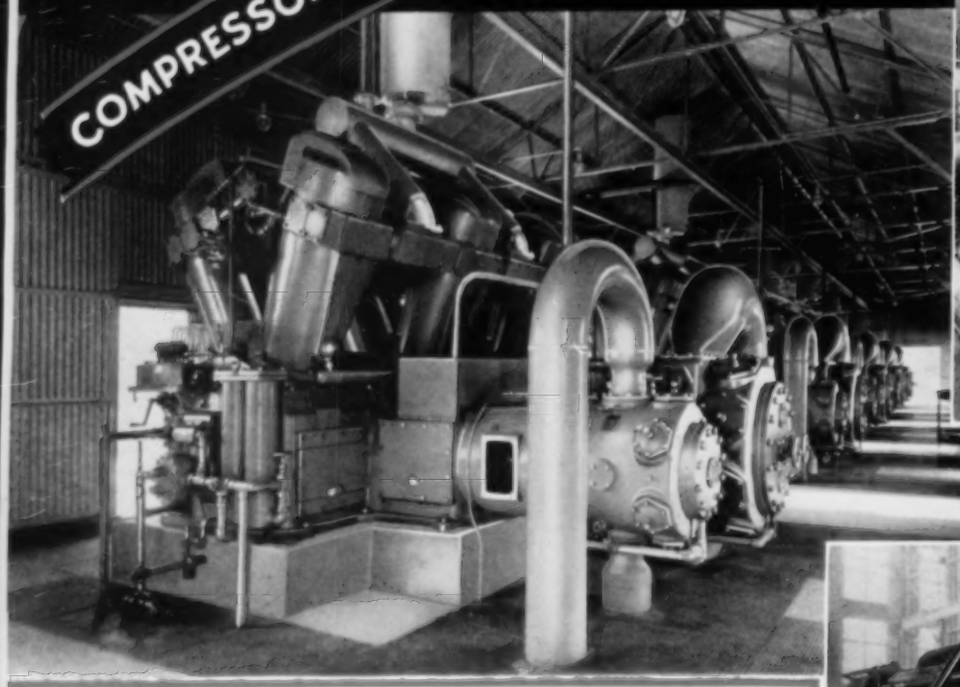
LOGANSPORT MACHINE, INCORPORATED

920 PAYSON ROAD LOGANSPORT, INDIANA

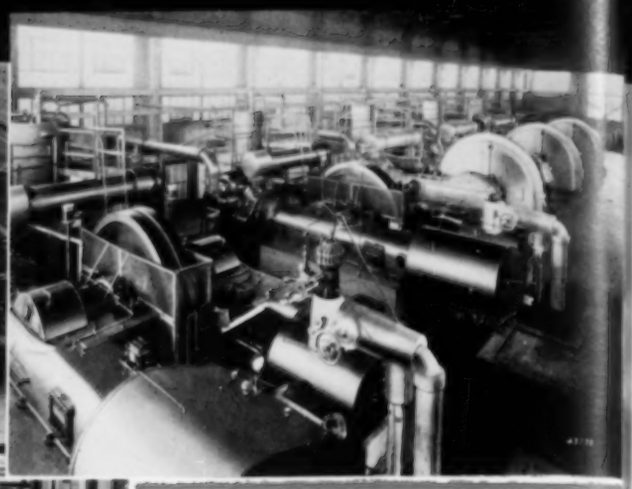
Manufacturers of Air and Hydraulic Devices, Chucks, Cylinders, Valves, Presses and Accessories

Ingersoll-Rand *Machinery*

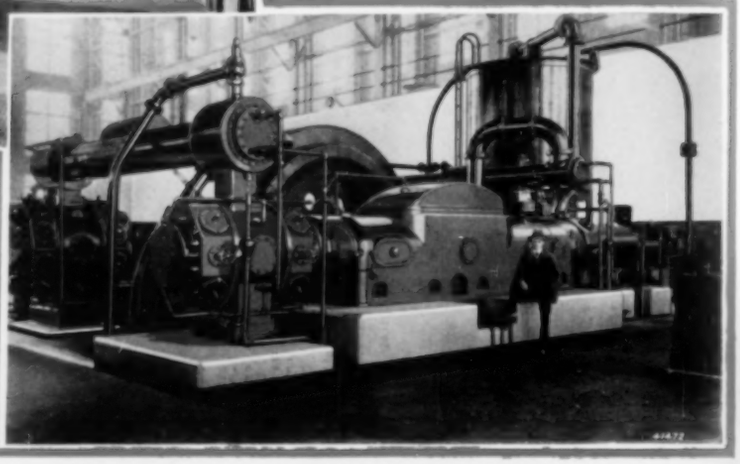
COMPRESSORS



These gas-engine-driven units are compressing natural gas in Arkansas. Ingersoll-Rand compressors range in size from ¼ to 3000 horsepower . . . and are driven by electric motors, steam, oil engines, or gas engines. Pressures range from vacuum to 15,000 lb per sq in. Installations of high-pressure machines total more than 150,000 hp.



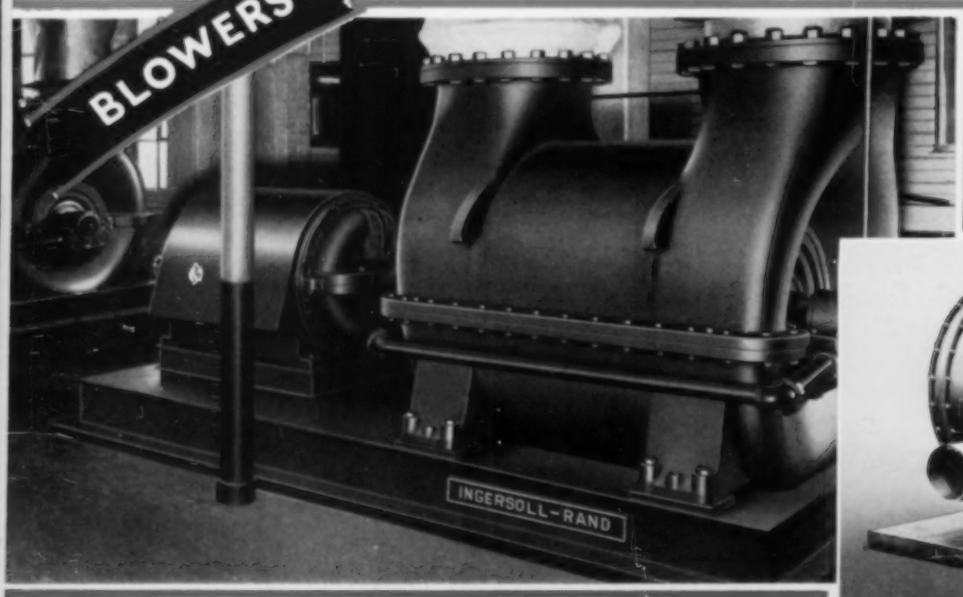
Five electric- and five steam-driven high-pressure compressors in a refinery.



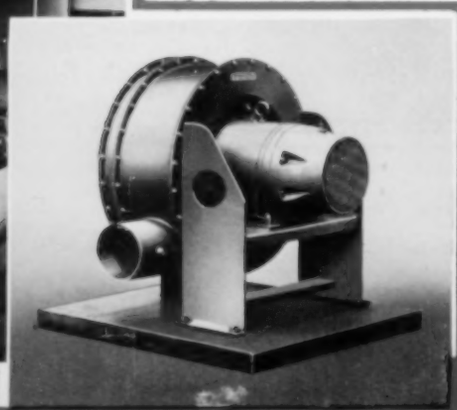
A 2,250-hp, six-stage machine compressing gas to 4,500 lb per sq in. pressure in a synthetic ammonia process.

BLOWERS

Blowers for air and many gases are available in sizes from 2 to 14,500 hp. At the left are shown two 400-hp vat agitation units.



A Type "G" MOTOR-BLOWER equipped with an explosion-proof motor for use in a munitions plant.



Aftercoolers
Air & Gas Lift Pumps
Blowers
Compressors
Condensers, Surface & Barometric Types
Core Drills
Diesel & Gas Engines
Hoists
Jackbits
Jackhamers
Paving Breakers
Pneumatic Tools
Pumps
Refrigerating Units
Rock Drills
Vacuum Pumps

for Vital Processes

We don't profess to be experts on the many refinery and other chemical processes . . . because each process has its own specialists who know what they need and how to procure the best equipment for the job.

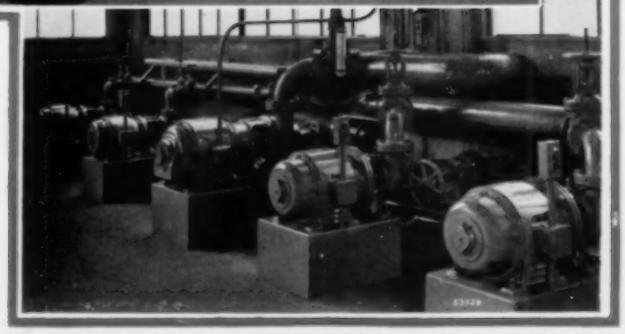
We have, however, earned the reputation of being experts in developing, manufacturing, and applying compressors, blowers, pumps, and vacuum equipment . . . machines that meet the rigid specifications of the process engineers, and that stand up under the operating conditions and continuous service required in recycling, gasoline extraction, and in the manufacture of aviation gasoline, synthetic rubber, synthetic ammonia, explosives, etc.

While new cycles or processes are still in the idea stage, our engineers are on the job with more than 50 years' experience in applying Ingersoll-Rand products to the problems of compression, pumping, vacuums, refrigeration, and condensation.

I-R heavy-duty machines are built and rated for continuous full-load operation, 24 hours a day, and they require only a minimum of time and money for inspection and repairs. And whenever new machines or new lines of equipment are developed specially for one industry or another, the keynote of I-R designers is flexibility and standardization of parts. Such a policy provides important advantages to every purchaser of Ingersoll-Rand equipment.

PUMPS

Below is a group of various types of Ingersoll-Rand refinery pumps. I-R pumps range in size from 5 to 100,000 gpm . . . for pressures up to 3,000 lb . . . temperatures up to 800°F . . . and can be built to handle practically any liquid.



Above are shown several Motorpumps—the versatile little units that have a million uses.

VACUUM EQUIPMENT

Ingersoll-Rand is in a position to recommend and build the proper vacuum equipment—whether steam-jet, reciprocating, or a combination of both types—and to furnish all auxiliaries to make a complete plant. Below is a combined 3-stage unit developed and standardized for a particular cyclic process.

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Ingersoll-Rand

11 BROADWAY, NEW YORK CITY

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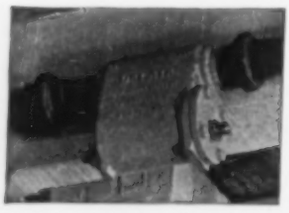
DEPENDABLE PNEUMATIC SERVICE

WHEN EQUIPMENT IS PROTECTED BY

DRIAIR

A COMPLETE SELF-CONTAINED UNIT



DriAir may be installed by suspending it from the piping without any other support.

A typical installation showing DriAir standing on the floor next to the wall.

● The answer to many problems which arise in various applications of compressed air, DriAir speeds production by separating and automatically ejecting the condensed water and oil from the air. DriAir collects dirt and rust from the air lines and delivers clean dry air to the tools, thus reducing wear and prolonging their life. All internal parts are made of bronze or copper—resistant to corrosion and practically permanent. Copy of Bulletin DA fully describing the operation of DriAir sent on request; write today.

NEW JERSEY METER COMPANY

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R. C. PILOT VALVES FOR POSITIVE CONTROL

R-C Unloader Pilot Valves (plain or strainer type) are standard on many leading compressors . . . installed as replacements on thousands of compressors in all parts of the U. S. A. and overseas. The R-C valve—positive in action—cannot chatter . . . it's always in open or closed position. Adjustment is provided for any unload-to-load range from 3% to 30% of maximum receiver pressure. Install an R-C Unloader Pilot valve—let performance prove its value. Specify air pressure and range of on-and-off operation desired. Write for price and recommendation.

R. C. PILOT VALVE STRAINER TYPE

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PILOT VALVES for Portable and Stationary Air Compressors provided with Unloaders

MAINTAIN *High-Speed* PRODUCTION ... USE WAGNER MOTORS ON YOUR COMPRESSORS!

Wagner Polyphase Squirrel-Cage motors are ideal for all compressor drives. Available in sizes 1/6 to 400-hp.

You can be assured of reliable performance, low maintenance, and continuity of service by specifying Wagner motors for your compressors. No matter what the job is—no matter what the operating conditions are—there is a Wagner motor that will keep your equipment on the job 24 hours a day—7 days a week.

Get the Facts . . .

Bulletins MU-176, MU-182, and MU-183 illustrate and describe the complete line of Wagner motors. Copies of these three valuable bulletins will be sent upon request.

BUY U.S. WAR BONDS

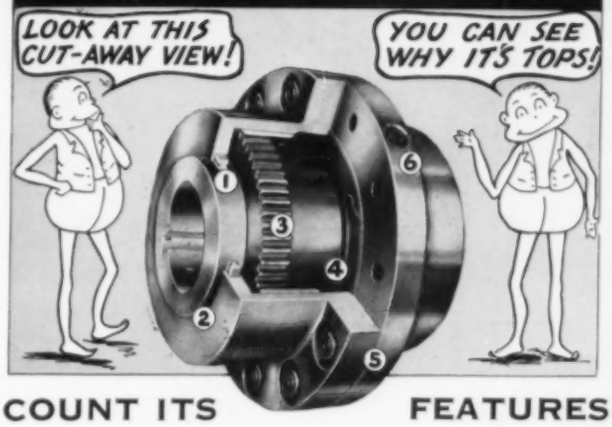
M42-30

Wagner Electric Corporation

6400 Plymouth Avenue, Saint Louis, Mo., U.S.A.

MOTORS · TRANSFORMERS · FANS · BRAKES

WALDRON Gear Type COUPLING



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1 Walflex Seal prevents dust entering or oil leaving coupling.

2 Hubs and Cover Sleeves made of Heat Treated Forgings.

3 Metal contact points between hub & sleeve automatically lubricated.

4 Longer lining up surface of hubs.

5 Cover sleeves function as a single rigid unit.

6 Shouldered oil plug with copper gasket insures positive seal.

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Removes 99% plus of water, dirt and oil from compressed air

THE unusual efficiency of the Johnson-Gast Separator arises from the fact that it combines, in one simple device, the two most effective principles of separation—expansion and change of direction. As the air enters it is allowed to expand, precipitating most of the moisture. Then it passes through the "thousand baffles"—a labyrinth of coarse wire mesh—changing direction of flow many times and surrendering particles of water and dirt at every turn.

In all Johnson-Gast Separating Devices you'll find this same combination of simple design and high efficiency. The After-cooler is frequently installed ahead of the separator to condense all moisture vaporized by heat of the compressor. A typical installation is pictured here. The Oil Absorber is used for services where every final trace of oil must be removed, as in paint spraying.

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FOR USE ON STEAM LINES TOO

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EVERY War Bond you buy helps preserve the freedom for which the Statue of Liberty stands.

Buying *quality* products brings Victory closer, too. The uniform high quality of *Garlock* packings, gaskets and oil seals is helping thousands of industrial plants maintain full production at top-speed, war-time efficiency.

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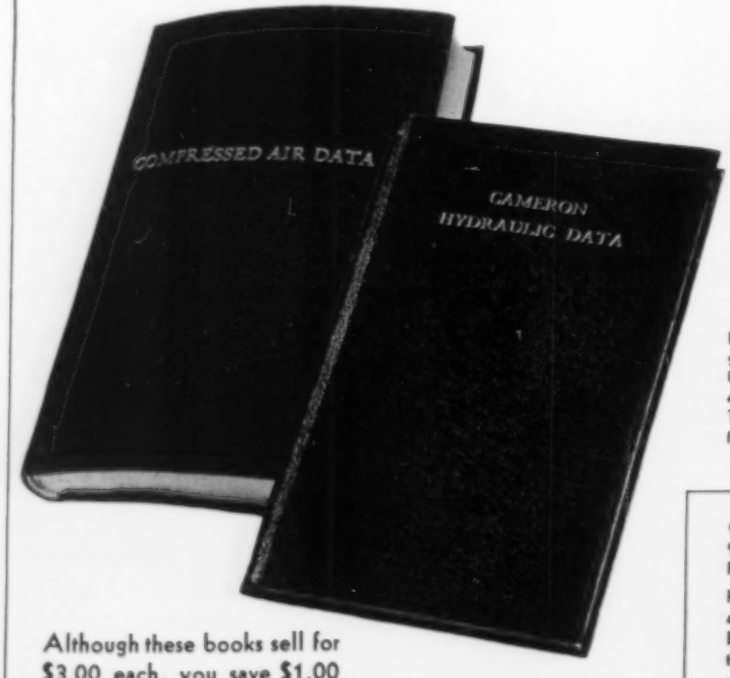

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MAXIMS

Noise and vibration, the twin nuisances of compressor intake lines, can be stilled for good, with the simple installation of a Maxim Silencer.

Throughout industry there's a continuing effort to improve working conditions by removing distractions that affect production. That is why Maxims are steadily going into both new and old plants . . . where they do their work year after year, with little maintenance.

Ask Maxim for the solution of exhaust or intake silencing problems.

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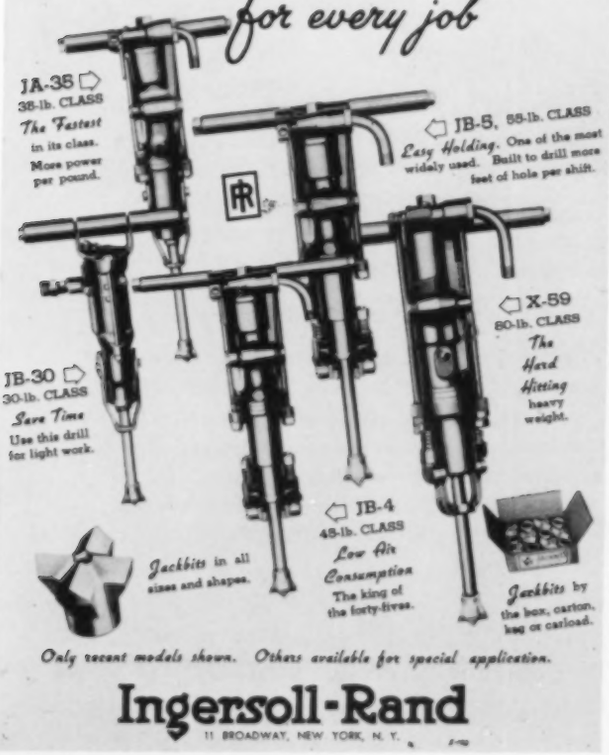
There's a **"Jackhamer"** *for every job*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The Fastest in its class. More power per pound.
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Easy Holding. One of the most widely used. Built to drill more feet of hole per shift.
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Jackbits in all sizes and shapes.
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Only recent models shown. Others available for special application.

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1. They save the worker's time

Each nut is a self-contained easy-to-handle unit that goes on fast . . . and its self-locking action is immediate and automatic.

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The locking element is built into the nut . . . no pins, wires, washers, or shims that can be forgotten or incorrectly applied.

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With less operations and less parts to be checked . . . there's another important saving in man-hours.

There are more Elastic Stop Nuts on America's airplanes, tanks, guns, Naval vessels, and production equipment, than all other lock nuts combined.

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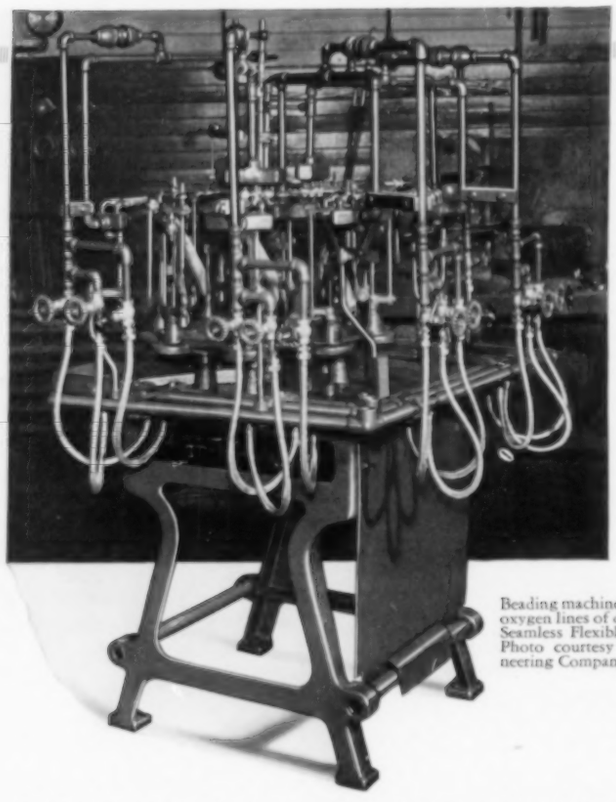
It has fought corrosion, high pressure and abrasion . . . and now fights *"BACKFIRES"* as well



Beading machine with air, gas and oxygen lines of durable American Seamless Flexible Metal Tubing. Photo courtesy of Kahle Engineering Company.

Frequent backfiring in the air, gas and oxygen lines on beading machines like the one above could seriously interfere with transmitter tube production . . . if the lines were not of American Seamless Flexible Metal Tubing.

American Seamless — corrugated from seamless rigid tubing . . . no welds, laps or joints . . . made in several alloys.

Less rugged materials would burst, creating fire hazards as well as interrupting work.

The purpose of the machine is to put an air-tight glass seal on filaments for transmitter tubes widely used in subs and planes. Oxygen flows through the American Seamless lines at a maximum pressure of 10 p.s.i., the gas at 1 p.s.i. and the air at 5 p.s.i.

American Interlocked —wound of strip metal, joints packed; the toughest type of extremely flexible metal hose.

This is typical of the contributions which American Seamless and its companion American Metal Hose products are making to our war effort. They are serving in all types of connecting and conveying duties . . . for vibration control, for the correction of misalignment and for wiring conduit.

42205

ANACONDA
from mine to consumer

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MILLIONS OF FEET OF AIR *Cleaned* AND *Quieted* DOWN

Quick facts about AIR-MAZE oil bath Filter-Silencers

1. 99.83% continuous protection against dust and dirt.
2. Less than 1½" H_2O pressure drop.
3. Constantly cleaned by automatic oil-washing action.
4. Highly efficient acoustical chamber.
5. Made in a wide range of sizes and capacities.

AIR-MAZE Oil Bath Filter-Silencers

reduce excessive noise . . . eliminate abrasive grit

When a large Eastern company decided to install this huge compressor in the power plant of their foundry, they faced the two way problem of:

1. **Protection of compressor against unusual dust conditions.**
2. **Protection of workmen from objectionable intake noises.**

As shown above, Air-Maze Oil Bath type Filter-Silencers provided the satisfactory answer. Automatic oil-washing action now handles the heavy dust load. The highly efficient acoustical silencer unit reduces intake noise to a minimum.

Have you a problem that involves the cleaning and quieting of intake air? It pays to ask the AIR-MAZE engineers first.

AIR-MAZE CORPORATION • *General Offices, CLEVELAND, OHIO*

AIR-MAZE

DEPENDABLE AIR FILTERS FOR EVERY APPLICATION

Dependable power for Victory, economical power for peace—with anti-friction-ized compressors Timken Bearing Equipped.

HELP ASSURE VICTORY

Buy War Bonds. Conserve Rubber. Eliminate Unnecessary Travel. Use the Telephone Only When Important. Salvage All Scrap and Waste Material.

All Timken Bearing production now goes into fighting machines. However, the Timken Bearings in your motor vehicles or industrial machines will see you through the emergency —and beyond it—if you make sure they are lubricated and inspected regularly.

When you are buying an anti-frictionized compressor of any type — portable or stationary — the question of what make of bearings are used is of the greatest importance. It might make all the difference between outstanding performance and mediocre performance.

If they are Timken Tapered Roller Bearings you can buy with the certainty of receiving the utmost satisfaction in efficiency; dependability; endurance; operating and maintenance economy.

Timken Bearings are the ideal anti-friction bearings for compressor service because they possess all of the qualities needed for this service. They eliminate friction, prevent wear on crank shafts, protect crank shafts against radial, thrust and combined loads and hold them in correct and constant alignment.

Ingersoll-Rand has used them for years and knows they can be depended upon for smooth, economical performance under any and all conditions—and so do users of Ingersoll-Rand anti-frictionized compressors.

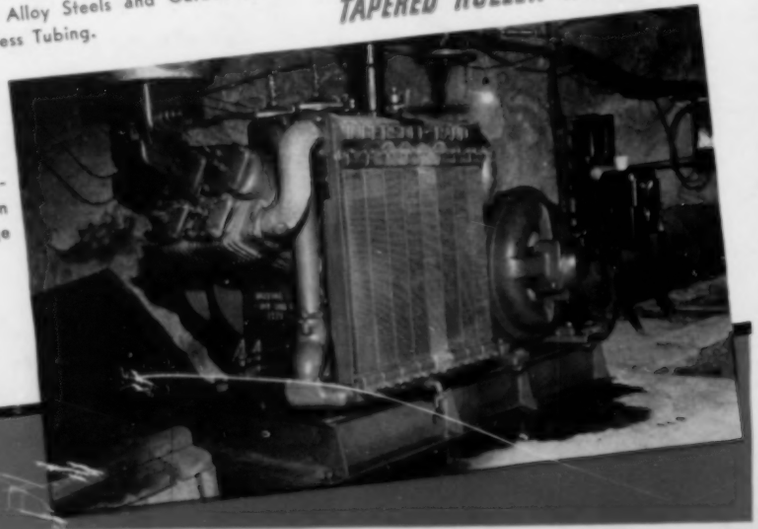
THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

Manufacturers of Timken Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; Timken Alloy Steels and Carbon and Alloy Seamless Tubing.



Ingersoll-Rand Motor Compressor equipped with Timken Bearings installed in a large western metal mine.